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*PSYCHOLOGY AND SOCIAL PRACTICE.**

IN coming before you I had hoped to deal with the problem of the relation of psychology to the social sciences—and through them to social practice, to life itself. Naturally, in anticipation, I had conceived a systematic exposition of fundamental principles covering the whole ground, and giving every factor its due rating and position. That discussion is not ready to-day. I am loath, however, completely to withdraw from the subject, especially as there happens to be a certain phase of it with which I have been more or less practically occupied within the last few years. I have in mind the relation of Psychology to Education. Since education is primarily a social affair, and since educational science is first of all a social science, we have here a section of the whole field. In some respects there may be an advantage in approaching the more comprehensive question through the medium of one of its special cases. The absence of elaborated and coherent views may be made up for by a background of experience, which shall check the projective power of reflective abstraction, and secure a translation of large words and ideas into specific images. This special territory, moreover, may be such as to afford both sign-posts and broad avenues to the larger

* Address of the President of the American Psychological Association, New Haven meeting, December, 1899.

sphere—the place of psychology among the social sciences. Because I anticipate such an outcome, and because I shall make a survey of the broad field from the special standpoint taken, I make no apology for presenting this discussion to an Association of Psychologists rather than to a gathering of educators.

In dealing with this particular question, it is impossible not to have in mind the brilliant and effective discourses recently published by my predecessor in this chair. I shall accordingly make free to refer to points, and at times to words, in his treatment of the matter. Yet, as perhaps I hardly need say, it is a problem of the most fundamental importance for both psychology and social theory that I wish to discuss, not any particular book or article. Indeed with much of what Dr. Münsterberg says about the uselessness and the danger for the teacher of miscellaneous scraps of child study, of unorganized information regarding the nervous system, and of crude and uninterpreted results of laboratory experiment, I am in full agreement. It is doubtless necessary to protest against a hasty and violent bolting of psychological facts and principles which, of necessity, destroys their scientific form. It is necessary to point out the need of a preliminary working over of psychological material adapting it to the needs of education. But these are minor points. The main point is whether the standpoint of psychological science, as a study of mechanism, is indifferent and opposed to the demands of education with its free interplay of personalities in their vital attitudes and aims.

I.

The school practice of to-day has a definite psychological basis. Teachers are already possessed by specific psychological assumptions which control their theory and their practice. The greatest obstacle to the introduction of certain educational reforms is precisely the permeating persistence of the underlying psychological creed. Traced back to its psychological ultimates, there are two controlling bases of existing methods of instruction. One is the assumption of a fundamental distinction between child psychology and the adult psychology where, in reality, identity reigns; viz.: in the region of the motives and conditions which make for mental power. The other is the assumption of likeness where marked difference is the feature most significant for educational purposes; I mean the specialization of aims and habits in the adult, compared with the absence of specialization in the child, and the connection of undifferentiated status with the full and free growth of the child.

The adult is primarily a person with a certain calling and position in life. These devolve upon him certain specific responsibilities which he has to meet, and call into play certain formed habits. The child is primarily one whose calling is growth. He is concerned with arriving at specific ends and purposes—instead of having a general framework already developed. He is engaged in forming habits rather than in definitely utilizing those already formed. Consequently he is absorbed in getting that all around contact with persons and things, that range of acquaintance with the physical and ideal factors of life, which shall afford the background and material for the specialized aims and pursuits of later life. He is, or should be, busy in the formation of a flexible variety of habits whose sole immediate criterion is their relation to full growth, rather than in acquiring certain skills whose value is measured by their reference to specialized technical accomplishments. This is the radical psychological and biological distinction, I take it, between the child and the adult. It is because of this distinction that children are neither physiologically nor mentally describable as 'little men and women.'

The full recognition of this distinction means of course the selection and arrangement of all school materials and methods for the facilitation of full normal growth, trusting to the result in growth to provide the instrumentalities of later specialized adaptation. If education means the period of prolonged infancy, it means nothing less than this. But look at our school system and ask whether the 3 R's are taught, either as to subject matter or as to method, with reference to growth, to its present demands and opportunities; or as technical acquisitions which are to be needed in the specialized life of the adult. Ask the same questions about geography, grammar and history. The gap between psychological theory and the existing school practice becomes painfully apparent. We readily realize the extent to which the present school system is dominated by carrying over into child life a standpoint and method which are significant in the psychology of the adult.

The narrow scope of the traditional elementary curriculum, the premature and excessive use of logical analytic methods, the assumption of ready-made faculties of observation, memory, attention, etc., which can be brought into play if only the child chooses to do so, the ideal of formal discipline—all these find a large measure of their explanation in neglect of just this psychological distinction between the child and the adult. The hold of these affairs upon the school is so fixed that it is impossible to shake it in any fundamental way, excepting by a thorough appreciation of the actual psychology of the case. This appreciation cannot be confined to the educational leaders and theorists. No individual instructor can be sincere and whole hearted, to say nothing of intelligent, in carrying into effect the needed reforms, save as he genuinely understands the scientific basis and necessity of the change.

But in another direction there is the assumption of a fundamental difference: Namely, as to the conditions which secure intellectual and moral progress and power.* No one seriously questions that, with an adult, power and control are obtained through realization of personal ends and problems, through personal selection of means and materials which are relevant, and through personal adaptation and application of what is thus selected, together with whatever of experimentation and of testing is involved in this effort. Practically every one of these three conditions of increase in power for the adult is denied for the child. For him problems and aims are determined by another mind. For him the material that is relevant and irrelevant is selected in advance by another mind. And, upon the whole, there is such an attempt to teach him a ready-made method for applying his material to the solution of his problems, or the reaching of his ends that the factor of experimentation is reduced to the minimum. With the adult we unquestioningly assume that an attitude of personal inquiry, based upon the possession of a problem which interests and absorbs, is a necessary precondition of mental growth. With the child we assume that the precondition is rather the willing disposition which makes him ready to submit to any problem and material presented from without. Alertness is our ideal in one case; docility in the other. With one, we assume that power of attention develops in dealing with problems which make a personal appeal, and through personal responsibility for determining what is relevant. With the other we provide next to no opportunities for the evolution of problems out of immediate experience, and allow next to no free mental play for selecting, assorting and adapting the ex-

*I owe this point specifically (as well as others more generally) to my friend and colleague, Mrs. Ella Flagg Young.

periences and ideas that make for their solution. How profound a revolution in the position and service of text-book and teacher, and in methods of instruction depending therefrom, would be effected by a sincere recognition of the psychological identity of child and adult in these respects can with difficulty be realized.

Here again it is not enough that the educational commanders should be aware of the correct educational psychology. The rank and file, just because they are persons dealing with persons, must have a sufficient grounding in the psychology of the matter to realize the necessity and the significance of what they are doing. Any reform instituted without such conviction on the part of those who have to carry it into effect would never be undertaken in good faith, nor in the spirit which its ideal inevitably demands; consequently it could lead only to disaster.

At this point, however, the issue defines itself, somewhat more narrowly. It may be true, it is true, we are told, that some should take hold of psychological methods and conclusions, and organize them with reference to the assistance which they may give to the cause of education. But this is not the work of the teacher. It belongs to the general educational theorist—the middleman between the psychologist and the educational practitioner. He should put the matter into such shape that the teacher may take the net results in the form of advice and rules for action; but the teacher who comes in contact with the living personalities must not assume the psychological attitude. If he does he reduces persons to objects, and thereby distorts, or rather destroys, the ethical relationship which is the vital nerve of instruction (*Psychology and Life*, p. 122, and pp. 136–138).

That there is some legitimate division of labor between the general educational theorist and the actual instructor, there is of course no doubt. As a rule, it will not be the one actively employed in instruction who will be most conscious of the psychological basis and equivalents of the educational work, nor most occupied in finding the pedagogical rendering of psychological facts and principles. Of necessity, the stress of interest will be elsewhere. But we have already found reason for questioning the possibility of making the somewhat different direction of interest into a rigid dualism of a legislative class on one side and an obedient subject class on the other. Can the teacher ever receive 'obligatory prescriptions'? Can he receive from another a statement of the means by which he is to reach his ends, and not become hopelessly servile in his attitude? Would not such a result be even worse than the existing mixture of empiricism and inspiration?—just because it would forever fossilize the empirical element and dispel the inspiration which now quickens routine. Can a passive, receptive attitude on the part of the instructor (suggesting the soldier awaiting orders from a commanding general) be avoided, unless the teacher, as a student of psychology, himself sees the reasons and import of the suggestions and rules that are proffered him?

I quote a passage that seems of significance: "Do we not lay a special linking science everywhere else between the theory and practical work? We have engineering between physics and the practical workingmen in the mills; we have a scientific medicine between the natural science and the physician" (p. 138). The sentences suggest in an almost startling way, that the real essence of the problem is found in an *organic* connection between the two extreme terms—between the theorist and the practical worker—through the medium of the linking science. The decisive matter is the extent to which the ideas of the theorist actually project themselves, through the

kind offices of the middle man, into the consciousness of the practitioner. It is the participation by the practical man in the theory, through the agency of the linking science, that determines at once the effectiveness of the work done, and the moral freedom and personal development of the one engaged in it. It is because the physician no longer follows rules, which, however rational in themselves, are yet arbitrary to him (because grounded in principles that he does not understand), that his work is becoming liberal, attaining the dignity of a profession, instead of remaining a mixture of empiricism and quackery. It is because, alas, engineering makes only a formal and not a real connection between physics and the practical workingmen in the mills, that our industrial problem is an ethical problem of the most serious kind. The question of the amount of wages the laborer receives, of the purchasing value of this wage, of the hours and conditions of labor, are, after all, secondary. The problem primarily roots in the fact that the mediating science does not connect with his consciousness, but merely with his outward actions. He does not appreciate the significance and bearing of what he does; and he does not perform his work because of sharing in a larger scientific and social consciousness. If he did, he would be free. All other proper accompaniments of wage, and hours, healthful and inspiring conditions would be added unto him, because he would have entered into the ethical kingdom. Shall we seek analogy with the teacher's calling in the workingmen in the mill, or in the scientific physician?

It is quite likely that I shall be reminded that I am overlooking an essential difference. The physician, it will be said, is dealing with a body which either is in itself a pure object, a causal interplay of anatomical elements, or is something which lends itself naturally and without essential loss to treatment from this point of view; while the case is quite different in the material with which the teacher deals. Here is personality, which is destroyed when regarded as an object. But the gap is not so pronounced nor so serious as this objection implies. The physician after all is not dealing with a lifeless body; with a simple anatomical structure, or interplay of mechanical elements. Life functions, active operations, are the reality which confront him. We do not have to go back many centuries in the history of medicine to find a time when the physician attempted to deal with these functions directly and immediately. They were so overpoweringly present, they forced themselves upon him so obviously and so constantly that he had no resource save a mixture of magic and empiricism: magic, so far as he followed methods derived from uncritical analogy, or from purely general speculation on the universe and life; empiricism, so long as he just followed procedures which had been found helpful before in cases which somewhat resembled the present. We have only to trace the intervening history of medicine to appreciate that it is precisely the ability to state function in terms of structure, to reduce life in its active operations to terms of a causal mechanism, which has taken the medical calling out of this dependence upon a vibration between superstition and routine. Progress has come by taking what is really an activity as if it were only an object. It is the capacity to effect this transformation of life activity which measures both the scientific character of the physician's procedure and his practical control, the certainty and efficacy of what he, as a living man, does in relation to some other living man.

It is an old story, however, that we must not content ourselves with analogies. We must find some specific reason in the principles of the teacher's own activities for

believing that psychology—the ability to transform a living personality into an objective mechanism for the time being—is not merely an incidental help, but an organic necessity. Upon the whole, the best efforts of teachers at present are partly paralyzed, partly distorted, and partly rendered futile precisely from the fact that they are in such immediate contact with sheer, unanalyzed personality. The relation is such a purely ethical and personal one that the teacher cannot get enough outside the situation to handle it intelligently and effectively. He is in precisely the condition in which the physician was when he had no recourse save to deal with health as entity or force on one side, and disease as opposing agency or invading influence upon the other. The teacher reacts *en bloc*, in a gross wholesale way, to something which he takes in an equally undefined and total way in the child. It is the inability to regard, upon occasion, both himself and the child as just objects working upon each other in specific ways that compels him to resort to purely arbitrary measures, to fall back upon mere routine traditions of school teaching, or to fly to the latest fad of pedagogical theorists—the latest panacea peddled out in school journals or teachers' institutes—just as the old physician relied upon his magic formula.

I repeat, it is the fundamental weakness of our teaching force to-day (putting aside teachers who are actually incompetent by reason either of wrong motives or inadequate preparation), that they react in gross to the child's exhibitions in gross without analyzing them into their detailed and constituent elements. If the child is angry, he is dealt with simply as an angry being; anger is an entity, a force, not a symptom. If a child is inattentive, this again is treated as a mere case of refusal to use the faculty or function of attention, of sheer unwillingness to act. Teachers tell you that a child is careless or inattentive in the same final way in which they would tell you that a piece of paper is white. It is just a fact, and that is all there is of it. Now it is only through some recognition of attention as a mechanism, some awareness of the interplay of sensations, images and motor impulses which constitute it as an objective fact that the teacher can deal effectively with attention as a function. And, of course, the same is true of memory, quick and useful observation, good judgment and all the other practical powers the teacher is attempting to cultivate.

Consideration of the abstract concepts of mechanism and personality is important. Too much preoccupation with them in a general fashion, however, without translation into relevant imagery of actual conditions is likely to give rise to unreal difficulties. The ethical personality does not go to school naked, it takes with it the body as the instrument through which all influences reach it, and through control of which its ideas are both elaborated and expressed. The teacher does not deal with personality at large, but as expressed in intellectual and practical impulses and habits. The ethical personality is not formed—it is forming. The teacher must provide stimuli leading to the equipment of personality with active habits and interests. When we consider the problem of forming habits and interests we find ourselves at once confronted with matters of this sort: What stimuli shall be presented to the sense organs and how? What stable complexes of associations shall be organized? What motor impulses shall be evoked, and to what extent? How shall they be induced in such a way as to bring favorable stimuli under greater control, and to lessen the danger of excitation from undesirable stimuli? In a word, the teacher is dealing with the psychical factors that are concerned with furtherance of certain habits, and the in-

hibition of others—habits intellectual, habits emotional, habits in overt action.

Moreover, all the instruments and materials with which the teacher deals must be considered as psychical stimuli. Such consideration involves of necessity, a knowledge of their reciprocal reactions—of what goes by the name of causal mechanism. The introduction of certain changes into a net-work of associations, the reinforcement of certain sensori-motor connections, the weakening or displacing of others—this is the psychological rendering of the greater part of the teacher's actual business. It is not that one teacher employs mechanical considerations, and that the other does not, appealing to higher ends; it is that one does not know his mechanism, and consequently acts servilely, superstitiously and blindly, while the other, knowing what he is about, acts freely, clearly and effectively.*

The same thing is true on the side of materials of instruction—the school studies. No amount of exaltation of teleological personality (however true, and however necessary the emphasis), can disguise from us the fact that instruction is an affair of bringing a child into intimate relations with concrete objects, positive facts, definite ideas and specific symbols. The symbols are objective things in arithmetic, reading and writing. The ideas are truths of history and of science. The facts are derived from such specific disciplines as geography and language, botany and astronomy. To suppose that by some influence of pure personality upon pure personality, conjoined with a knowledge of rules formulated by an educational theorist, an effective interplay of this body of physical and ideal objects with the life of the child can be effective, is, I submit, nothing but an appeal to magic, plus dependence upon servile routine. Symbols in reading and writing and number, are both in themselves, and in the way in which they stand for ideas, elements in a mechanism which has to be rendered operative within the child. To bring about this influence in the most helpful and economical way, in the most fruitful and liberating way, is absolutely impossible save as the teacher has some power to transmute symbols and contents into their working psychical equivalents: and save as he also has the power to see what it is in the child, as a psychical mechanism, that affords maximum leverage.

Probably I shall now hear that at present the danger is not of dealing with acts and persons in a gross, arbitrary way, but (so far as what is called new education is concerned) in treating the children too much as mechanism, and consequently seeking for all kinds of stimuli to stir and attract—that, in a word, the tendency to reduce instruction to a merely agreeable thing, weakening the child's personality and indulging his mere love of excitement and pleasure, is precisely the result of taking the psycho-mechanical point of view. I welcome the objection for it serves to clear up the precise point. It is through a partial and defective psychology that the teacher, in his reaction from dead routine and arbitrary moral and intellectual discipline, has substituted an appeal to the satisfaction of momentary impulse. It is not because the teacher has a knowledge of the psycho-physical mechanism, but because he has a partial knowledge of it. He has come to consciousness of certain sensations, and certain impulses, and of the ways in which these may be stimulated and directed, but he is in ignorance of the larger mechanism (just as a mechanism), and of the causal relations which subsist between the un-

*That some teachers get their psychology by instinct more effectively than others by any amount of reflective study may be unreservedly stated. It is not a question of manufacturing teachers, but of reinforcing and enlightening those who have a right to teach.

known part and the elements upon which he is playing. What is needed to correct his errors is not to inform him that he gets only misleading from taking the psychical point of view; but to reveal to him the scope and intricate interactions of the mechanism as a whole. Then he will realize that while he is gaining apparent efficacy in some superficial part of the mechanism, he is disarranging, dislocating and disintegrating much more fundamental factors in it. In a word he is operating not as a psychologist, but as a poor psychologist, and the only cure for a partial psychology is a fuller one. He is gaining the momentary attention of the child through an appeal to pleasant color, or exciting tone, or agreeable association, but at the expense of isolating one cog and ratchet in the machinery, and making it operate independently of the rest. In theory, it is as possible to demonstrate this to a teacher, showing how the faulty method reacts unhappily into the personality, as it is to locate the points of wrong construction, and of ineffective transfer of energy in a physical apparatus.

This suggests the admission made by writers in many respects as far apart as Dr. Harris and Dr. Münsterberg—that scientific psychology is of use on the pathological side—where questions of 'physical and mental health' are concerned. But is there anything with which the teacher has concern that is not included in the ideal of physical and mental health? Does health define to us anything less than the teacher's whole end and aim? Where does pathology leave off in the scale and series of vicious aims and defective means? I see no line between the more obvious methods and materials which result in nervous irritation and fatigue; in weakening the power of vision, in establishing spinal curvatures; and others which, in more remote and subtle, but equally real ways, leave the child with, say, a muscular system which is only partially at the service of his ideas, with blocked and inert brain paths between eye and ear, and with a partial and disconnected development of the cerebral paths of visual imagery. What error in instruction is there which could not, with proper psychological theory, be stated in just such terms as these? A wrong method of teaching reading, wrong I mean in the full educational and ethical sense, is also a case of pathological use of the psycho-physical mechanism. A method is ethically defective that, while giving the child a glibness in the mechanical facility of reading, leaves him at the mercy of suggestion and chance environment to decide whether he reads the 'yellow journal,' the trashy novel, or the literture which inspires and makes more valid his whole life. Is it any less certain that this failure on the ethical side is repeated in some lack of adequate growth and connection in the psychical and physiological factors involved? If a knowledge of psychology is important to the teacher in the grosser and more overt cases of mental pathology is it not even more important in these hidden and indirect matters—just because they are less evident and more circuitous in their operation and manifestation?

The argument may be summarized by saying that there is controversy neither as to the ethical character of education, nor as to the abstraction which psychology performs in reducing personality to an object. The teacher is, indeed, a person occupied with other persons. He lives in a social sphere—he is a member and an organ of a social life. His aims are social aims; the development of individuals taking ever more responsible positions in a circle of social activities continually increasing in radius and complexity. Whatever he as a teacher effectively does, he does as a person; and he does with and towards persons. His methods, like his aims, when

actively in operation, are practical, are social, are ethical, are anything you please —save merely psychical. In comparison with this, the material and the data, the standpoint and the methods of psychology, are abstract. They transform specific acts and relations of individuals into a flow of processes in consciousness; and these processes can be adequately identified and related only through reference to a biological organism. I do not think there is danger of going too far in asserting the social and teleological nature of the work of the teacher; or in asserting the abstract and partial character of the mechanism into which the psychologist, as a psychologist, transmutes the play of vital values.

Does it follow from this that any attempt on the part of the teacher to perform this abstraction, to see the pupil as a mechanism, to define his own relations and that of the study taught in terms of causal influences acting upon this mechanism, are useless and harmful? On the face of it, I cannot understand the logic which says that because mechanism is mechanism, and because acts, aims, values are vital, therefore a statement in terms of one is alien to the comprehension and proper management of the other. Ends are not compromised when referred to the means necessary to realize them. Values do not cease to be values when they are minutely and accurately measured. Acts are not destroyed when their operative machinery is made manifest. The statement of the disparity of mechanism and actual life, be it never so true, solves no problem. It is no distinction that may be used off-hand to decide the question of the relation of psychology to any form of practice. It is a valuable and necessary distinction; but it is only preliminary. The purport of our discussion has, indeed, led us strongly to suspect any ideal which exists purely at large, out of relation to machinery of execution, and equally a machinery that operates in no particular direction.

The proposition that a description and explanation of stones, iron and mortar, as an absolutely necessary causal nexus of mechanical conditions, makes the results of physical science unavailable for purposes of practical life, would hardly receive attention to-day. Every sky-scraper, every railway bridge is a refutation, compared with which oceans of talk are futile. One would not find it easy to stir up a problem even if he went on to include, in this same mechanical system, the steam derricks that hoist the stones and iron, and the muscles and nerves of architect, mason and steel worker. The simple fact is still too obvious; the more thorough-going and complete the mechanical and causal statement, the more controlled, the more economical is the discovery and realization of human aims. It is not in spite of nor in neglect of, but because of the mechanical statement that human activity has been freed, and made effective in thousands of new practical directions, upon a scale and with a certainty hitherto undreamed of. Our discussion tends to suggest that we entertain a similar question regarding psychology only because we have as yet made so little headway—just because there is so little scientific control of our practice in these directions; that at bottom our difficulty is local and circumstantial, not intrinsic and doctrinal. If our teachers were trained as architects are trained, if our schools were actually managed on a psychological basis as great factories are run on the basis of chemical and physical science; if our psychology were sufficiently organized and coherent to give as adequate a mechanical statement of human nature as physics does of its material, we should never dream of discussing this question.

I cannot pass on from this phase of the discussion without at least incidental re-

mark of the obverse side of the situation. The difficulties of psychological observation and interpretation are great enough in any case. We cannot afford to neglect any possible auxiliary. The great advantage of the psychological laboratory is paid for by certain obvious defects. The completer control of conditions, with resulting greater accuracy of determination, demands an isolation, a ruling out of the usual media of thought and action, which leads to a certain remoteness, and easily to a certain artificiality. When the result of laboratory experiment informs us, for example, that repetition is the chief factor influencing recall, we must bear in mind that the result is obtained with nonsense material—*i. e.*, by excluding the conditions of ordinary memory. The result is pertinent if we state it thus: The more we exclude the usual environmental adaptations of memory the greater importance attaches to sheer repetition. It is dubious (and probably perverse) if we say: Repetition is the prime influence in memory.

Now this illustrates a general principle. Unless our laboratory results are to give us artificialities, mere scientific curiosities, they must be subjected to interpretation by gradual reapproximation to conditions of life. The results may be very accurate, very definitive in form; but the task of reviewing them so as to see their actual import is clearly one of great delicacy and liability to error. The laboratory, in a word, affords no final refuge that enables us to avoid the ordinary scientific difficulties of forming hypotheses, interpreting results, etc. In some sense (from the very accuracy and limitations of its results) it adds to our responsibilities in this direction. Now the school, for psychological purposes, stands in many respects midway between the extreme simplifications of the laboratory and the confused complexities of ordinary life. Its conditions are those of life at large; they are social and practical. But it approaches the laboratory in so far as the ends aimed at are reduced in number, are definite, and thus simplify the conditions; and their psychological phase is uppermost—the formation of habits of attention, observation, memory, etc.—while in ordinary life these are secondary and swallowed up.

If the biological and evolutionary attitude is right in looking at mind as fundamentally an instrument of adaptation, there are certainly advantages in any mode of approach which brings us near to its various adaptations while they are still forming, and under conditions selected with special reference to promoting these adaptations (or faculties). And this is precisely the situation we should have in a properly organized system of education. While the psychological theory would guide and illuminate the practice, acting upon the theory would immediately test it, and thus criticise it, bringing about its revision and growth. In the large and open sense of the words psychology becomes a working hypothesis, instruction is the experimental test and demonstration of the hypothesis; the result is both greater practical control and continued growth in theory.

II.

I must remind myself that my purpose does not conclude with a statement of the auxiliary relation of psychology to education; but that we are concerned with this as a type case of a wider problem—the relation of psychology to social practice in general. So far I have tried to show that it is not in spite of its statement of personal aims and social relations in terms of mechanism that psychology is useful, but because of this transformation and abstraction. Through reduction of ethical relations to presented objects, we are enabled to get outside of the existing situation; to

see it objectively, not merely in relation to our traditional habits, vague aspirations and capricious desires. We are able to see clearly the factors which shape it, and therefore to get an idea of how it may be modified. The assumption of an identical relationship of physics and psychology to practical life is justified. Our freedom of action comes through its statement in terms of necessity. By this translation our control is enlarged, our powers are directed, our energy conserved, our aims illuminated

The school is an especially favorable place in which to study the availability of psychology for social practice, because in the school the formation of a certain type of social personality, with a certain attitude and equipment of working powers, is the express aim. In idea at least no other purpose restricts or compromises the dominance of the single purpose. Such is not the case in business, politics and the professions. All these have upon their surface, taken directly, other ends to serve. In many instances these other aims are of far greater immediate importance; the ethical result is subordinate or even incidental. Yet as it profiteth a man nothing to gain the whole world and lose his own self, so indirectly and ultimately all these other social institutions must be judged by the contribution which they make to the value of human life. Other ends may be immediately uppermost, but these ends must in turn be means; they must subserve the interests of conscious life or else stand condemned.

In other words, the moment we apply an ethical standard to the consideration of social institutions, that moment they stand on exactly the same level as does the school, viz.: as organs for the increase in depth and area of the realized values of life. In both cases the statement of the mechanism, through which the ethical ends are realized, is not only permissible, but absolutely required. It is not merely incidentally, as a grateful addition to its normal task, that psychology serves us. The essential nature of the standpoint which calls it into existence, and of abstraction which it performs, is to put in our possession the method by which values are introduced and effected in life. The statement of personality as an object; of social relations as a mechanism of stimuli and inhibitions, is precisely the statement of ends in terms of the method of their realization.

It is remarkable that men are so blind to the futility of a morality which merely blazons ideals, erects standards, asserts law without finding in them any organic provision for their own realization. For ideals are held up to follow; standards are given to work by; laws are provided to guide action. The sole and only reason for their conscious moral statement is, in a word, that they may influence and direct conduct. If they cannot do this, not merely by accident, but of their own intrinsic nature, they are worse than inert. They are impudent impostors and logical self-contradictions.

When men derive their moral ideas and laws from custom, they also realize them through custom; but when they are in any way divorced from habit and tradition, when they are consciously proclaimed, there must be some substitute for custom as an organ of execution. We must know the method of their operation and know it in detail. Otherwise the more earnestly we insist upon our categorial imperatives, and upon their supreme right of control, the more flagrantly helpless we are as to their actual domination. The fact that conscious, as distinct from customary, morality and psychology have had a historic parallel march, is just the concrete recognition of the necessary equivalence between ends consciously conceived, and interest in the means upon which the ends depend. We have the same reality stated twice

over: once as value to be realized, and once as mechanism of realization. So long as custom reigns, as tradition prevails, so long as social values are determined by instinct and habit, there is no conscious question as to the method of their achievement, and hence no need of psychology. Social institutions work of their own inertia, they take the individual up into themselves and carry him along in their own sweep. The individual is dominated by the mass life of his group. Institutions and the customs attaching to them take care of society both as to its ideals and its methods. But when once the values come to consciousness, when once a Socrates insists upon the organic relation of a reflective life and morality, then the means, the machinery by which ethical ideas are projected and manifested, comes to consciousness also. Psychology must needs be born as soon as morality becomes reflective.

Moreover, psychology, as an account of the mechanism of workings of personality, is the only alternative to an arbitrary and class view of society, to an aristocratic view in the sense of restricting the realization of the full worth of life to a section of society. The growth of a psychology that, as applied to history and sociology, tries to state the interactions of groups of men in familiar psychical categories of stimulus and inhibition, is evidence that we are ceasing to take existing social forms as final and unquestioned. The application of psychology to social institutions is the only scientific way of dealing with their ethical values in their present unequal distribution, their haphazard execution and their thwarted development. It marks just the recognition of the principle of sufficient reason in the large matters of social life. It is the recognition that the existing order is determined neither by fate nor by chance, but is based on law and order, on a system of existing stimuli and modes of reaction, through knowledge of which we can modify the practical outcome. There is no logical alternative save either to recognize and search for the mechanism of the interplay of personalities that controls the existing distributions of values, or to accept as final a fixed hierarchy of persons in which the leaders assert, on no basis save their own supposed superior personality, certain ends and laws which the mass of men passively receive and imitate. The effort to apply psychology to social affairs means that the determination of ethical values lies not in any set or class, however superior, but in the workings of the social whole; that the explanation is found in the complex interactions and interrelations which constitute this whole. To save personality in all, we must serve all alike—state the achievements of all in terms of mechanism, that is, of the exercise of reciprocal influence. To affirm personality independent of mechanism is to restrict its full meaning to a few, and to make its expression in the few irregular and arbitrary.

The anomaly in our present social life is obvious enough. With tremendous increase in control of nature, in ability to utilize nature for the indefinite extension and multiplication of commodities for human use and satisfaction, we find the actual realization of ends, the enjoyment of values growing unassured and precarious. At times it seems as if we were caught in a contradiction; the more we multiply means, the less certain and general is the use we are able to make of them. No wonder a Carlyle or a Ruskin puts our whole industrial civilization under a ban, while a Tolstoi proclaims a return to the desert. But the only way to see the situation steadily, and to see it as a whole, is to keep in mind that the entire problem is one of the development of science, and of its application to life. Our control of nature with the accompanying output of material commodities

is the necessary result of the growth of physical science—of our ability to state things as interconnected parts of a mechanism. Physical science has for the time being far outrun psychical. We have mastered the physical mechanism sufficiently to turn out possible goods; we have not gained a knowledge of the conditions through which possible values become actual in life, and so are still at the mercy of habit, of haphazard, and hence of force.

Psychology, after all, simply states the mechanism through which conscious value and meaning are introduced into human experience. As it makes its way, and is progressively applied to history and all the social sciences, we can anticipate no other outcome than increasing control in the ethical sphere—the nature and extent of which can be best judged by considering the revolution that has taken place in the control of physical nature through a knowledge of her order. Psychology will never provide ready-made materials and prescriptions for the ethical life, any more than physics dictates off-hand the steam engine and the dynamo. But science, both physical and psychological, makes known the conditions upon which certain results depend, and therefore puts at the disposal of life a method for controlling them. Psychology will never tell us just what to do ethically, nor just how to do it. But it will afford us insight into the conditions which control the formation and execution of aims, and thus enable human effort to expend itself sanely, rationally and with assurance. We are not called upon to be either boasters or sentimentalists regarding the possibilities of our science. It is best, for the most part, that we should stick to our particular jobs of investigation and reflection as they come to us. But we certainly are entitled in this daily work to be sustained by the conviction that we are not working in indifference to or at cross-purposes with the practical strivings of our common humanity. The psychologist, in his most remote and technical occupation with mechanism, is contributing his bit to that ordered knowledge which alone enables mankind to secure a larger and to direct a more equal flow of values in life.

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THE MARINE BIOLOGICAL LABORATORY.

THE twelfth annual session of the Marine Biological Laboratory at Woods Holl, Mass., which was held during the past summer, was lacking in none of the elements of interest and success which have made former sessions notable, while several new and valuable features were added last year for the first time. In addition to the regular courses of instruction in Zoology, Embryology and Botany, there was given last year, under the direction of Professor Loeb, a course on Comparative Physiology. Such a course can be given advantageously only at the seashore where living animals of all classes may be had in abundance. In the organization of this course the Woods Holl Laboratory has taken a unique and advanced position which cannot fail to yield valuable results not only to research but also to physiological instruction throughout the country. Another notable feature was the course of lectures and demonstrations in Comparative Psychology given by Dr. Thorndike. This course was followed with the keenest interest by a large number of persons at Woods Holl. The general lectures, a volume of which is published annually, were unusually numerous and valuable. The facilities for dredging in deep water and for making extensive collecting trips were never before so good, thanks to the courtesies of the Fish Commission Station. The United States Fish Commission steamer, *Fishhawk* and schooner *Grampus*, were sta-

tioned at Woods Holl and they, with the smaller vessels of the Commission and of the Marine Biological Laboratory, formed a fleet of vessels equipped for scientific work such as has rarely assembled in one place before.

The attendance at the Laboratory was gratifyingly large; there were seventy-one investigators and seventy-eight students, representing sixty-nine different schools, colleges and universities. When it is remembered that there were last year three other marine laboratories on our Atlantic coast, offering their facilities freely, or for much less than the fee at the Marine Biological Laboratory, there is all the more reason for satisfaction at the large number in attendance. In the character and variety of the research work done the past season was not excelled by any preceding one, and in some respects it surpassed them all.

All these features show that the Marine Biological Laboratory is to-day, as much as at any time in its past history, the center of biological instruction and investigation in this country. This can still be said in spite of the fact that there are numerous other marine and fresh water stations in this country, which are doing excellent work and are worthy of generous praise and support. However, no other American station has the national and even cosmopolitan character of the Woods Holl Laboratory; no other enjoys the coöperation of so large a number of educational and scientific institutions, no where else is the whole field of biology so fully represented and no other American laboratory is so productive in original work, nor has so large a number of investigators and students.

The Marine Biological Laboratory is a shining illustration of the fact that men and not buildings nor material equipment make an institution great. There is probably no other educational or scientific institution in the world which on so small a financial basis has accomplished so great a work. This work is of such scientific and educational value and the Laboratory stands for so fine an ideal of scientific coöperation that a brief account of its history and work should not be wholly lacking in interest or suggestiveness.

The Laboratory can claim to be a lineal descendant of the first marine laboratory in America, the school established by Louis Agassiz in 1873, on the island of Penikese, in Buzzards Bay. The Penikese Laboratory was abandoned in 1874 at the close of its second session, after having received in buildings, equipment and endowment, more money than has been given to the Marine Biological Laboratory during the twelve years of its history. This step was made necessary on account of the unfortunate location of the laboratory on an isolated island, and above all by the death of the man whose genius had created it and who alone was able to secure the scientific coöperation necessary to its maintenance. After the closure of the Penikese Laboratory an attempt was made to secure the coöperation of educational and scientific institutions in establishing a marine laboratory at Woods Holl, but the support was not forthcoming at that time and the project was abandoned.

In 1880 the Woman's Educational Association of Boston, acting in coöperation with the Boston Society of Natural History, opened a seaside laboratory at Annisquam, Mass., and this continued in operation for six years. In 1886 the supporters of that laboratory addressed a circular letter to many leading biologists in this country asking their coöperation in the work of establishing the laboratory on a broader basis. In March, 1887, a meeting of persons interested in the enterprise was held in Boston, and a committee was appointed "to perfect plans for the organization of a permanent seaside laboratory, to elect trustees and to

devise ways and means for collecting the necessary funds." In the spring of 1888 about ten thousand dollars had been secured, and accordingly the Marine Biological Laboratory was incorporated and steps were taken to open it that season. After prolonged consideration the trustees decided to locate the laboratory at Woods Holl, Mass., and the whole history of the institution has shown the wisdom of this decision.

The natural advantages of Woods Holl deserve especial emphasis because they have been fundamental to the success of the Laboratory. In a good location a biological laboratory may be highly successful with very little equipment, while in a poor location no amount of money can make up for this defect.

In 1881 Professor Baird determined to locate the marine laboratory of the U. S. Fish Commission at Woods Holl, after having investigated, during the preceding ten years, almost every available point on the Atlantic coast. It is doubtful whether at any other single place on this coast so many valuable and important features can be found. The only other place seriously considered by Professor Baird was Newport, R. I., and this was finally rejected because of the relative impurity of the water of Narragansett Bay. On the other hand the waters of Buzzards Bay and Vineyard Sound are of exceptional purity, there being no large fresh water streams in the vicinity nor cities discharging their filth into the waters. In the immediate vicinity of Woods Holl are numerous harbors and lagoons, with muddy, sandy or rocky bottoms, while the coast is so broken by bays, promontories, straits and islands as to afford the most varied habitats. In addition the tide currents which sweep in through the sound and 'hole' bring in multitudes of floating animals and plants, many of which are tropical forms carried in from the Gulf Stream, which is distant only about one hundred miles. The proximity of the Gulf Stream to this portion of the New England coast gives a laboratory located at this point many of the advantages of a tropical station without any of the accompanying disadvantages. There are also many fresh water ponds and lakes in the vicinity which contain a rich fauna and flora. Add to these things the fact that Woods Holl

FIG. 1. Main Building, Marine Biological Laboratory.

is readily accessible by rail or boat, that the climate in summer is delightful, the bathing excellent, the mainland and islands charming, the sound with its continual procession of ships always varied and interesting, and you have in Woods Holl not only an ideal place for a laboratory, but also an ideal place for summer residence.

Having determined to locate the Laboratory at Woods Holl, the Trustees bought a small piece of land near the Fish Commission Station and erected upon it a plain wooden building, 63 x 28 feet and two stories high. This was equipped with the most necessary apparatus and the Marine Biological Laboratory was first opened July 17, 1888.

From the first it was determined that the Laboratory should not be under the control of any college, university or other institution, but that it should be truly national in character and that it should invite the coöperation of all persons and institutions interested in the advancement of the science of Biology. Accordingly the Laboratory was organized on an independent foundation.

Its government was vested in a Corporation and a Board of Trustees. The Corporation, at first ten in number, now consists of several hundred persons, many of them present or former students and investigators at the Laboratory, who are interested in its welfare and have contributed to its support. The Corporation elects annually six members of the Board of Trustees, passes upon all proposed changes in the Constitution and By-Laws, hears an annual report from the Director and the Treasurer and makes such recommendations concerning the general policy of the Laboratory as it may desire. The Board of Trustees, at first seven in number, now consists of twenty-seven members, some of them business men of recognized ability, but most of them biologists representing prominent educational institutions in almost every part of the United States and Canada. The Board has direct charge of the property and funds of the Laboratory, elects the Director and Assistant Director, and has general supervision of the scientific work.

From the first the institution has been under the directorship of Professor C. O. Whitman, and it is but simple justice to say that the remarkable success which has attended it is due in large measure to the high ideals and the untiring energy and sacrifice of Professor Whitman. For twelve years he has devoted himself to the Laboratory without compensation and with an enthusiasm which has served to inspire many others with his own ideals concerning the Laboratory and to enlist their hearty coöperation.

In his address at the opening of the Laboratory and in subsequent publications, Professor Whitman took the position that there was great need for a laboratory which should represent, (1) the whole of biology; (2) both teaching and research; (3) the widest possible coöperation of educational and scientific institutions. Such a laboratory should not be merely a collecting station, nor a summer school, nor a scientific work shop, nor a congress of biologists, but all of these; an institution combining in itself the functions and features of the best biological institutes of the world, having the coöperation of the biologists of this country, and thus forming "a national center of instruction and research in every department of Biology." The history of the Laboratory has shown that this ambitious project is not only highly desirable, but that it is entirely feasible and has justified the claim of the Director that such an institution is the greatest need of American biology.

"The new laboratory at Woods Holl," said the director in his first report, "is

nothing more and I trust nothing less than a first step toward the establishment of an ideal biological station, organized on a basis broad enough to represent all important features of the several types of laboratories hitherto known in Europe and America. * * * An undertaking of such magnitude cannot be a matter of local interest merely, and if it be pushed with energy and wisdom, it cannot fail to receive the support of the universities, colleges and schools of the country." There was little in the early conditions of the laboratory to justify such high hopes. It began with no assured co-operation, no constituency, a bare building, no library, no private rooms for investigators, only a row boat for collecting and with only two instructors, seven investigators and eight students.

Fig. 2. Main Building, Botanical Laboratory, Lecture Hall and Research Laboratory.

Since that time the growth of the laboratory in material equipment has been encouraging, while its growth in numbers and in the scope and volume of scientific work has been phenomenal. During the second season $1000 was given to establish the Glendower Evans Library; $2500 was raised in Boston to establish two scholarships at the laboratory as a memorial to Lucretia Crocker, long a supervisor in the public schools of Boston. During the third season a lecture hall and library room were constructed as an addition to the building and the 'Gifford Homestead,' together with about one-half acre of land adjoining the Fish Commission was purchased, the house being converted into a dining hall; a steam launch was also secured. In the fifth year an additional laboratory of the size of the original building was constructed. In the seventh year a new laboratory was built for botany and a large dining hall was erected, capable of accommodating two hundred people at one time. In the ninth year a building containing a large lecture hall and research laboratories was constructed and a two-masted schooner was added to the fleet of collecting boats.

Although this growth in material equipment has been rapid, the needs of the laboratory have grown still more rapidly. The buildings are all of a temporary character and can be used only in summer; at least one substantial, fire-proof building is needed which can be used the year around; the library is inadequate to the needs of such an institution; the facilities for collecting should be enlarged and increased; the Laboratory is entirely dependent upon the Fish Commission Station for wharf privileges and for pumping sea water to its aquaria and, although cordial and mutually helpful relations have always existed between the two stations, additional land, with shore privileges, ought to be secured while it can be had; above all the Laboratory needs increased endowments both for special purposes, such as scholarships, library, publications, etc., and also for general maintenance.

Fig. 3. Fish Commission Buildings, Wharf and Steamer, one of the Marine Biological Laboratory Buildings on the right.

The growth in material equipment, though encouraging, is overshadowed in importance by the growth in the number of persons in attendance at the Laboratory. In 1888 there were nine investigators and eight students representing thirteen different institutions of learning; in 1899 there were seventy one investigators and seventy-eight students representing sixty-nine different institutions. In all during the twelve sessions there have been in attendance five hundred and ten investigators and seven hundred and forty-five students from nearly three hundred different educational and scientific institutions, while among the occasional lecturers and visitors must be numbered almost all the better known biologists of this country and many from foreign lands.

As the outgrowth of a summer school it might have been expected that the laboratory would give instruction in biological subjects, and at its very beginning its founders resolved that it should also give opportunity for original research. The combination of these two functions at the Laboratory has been a peculiarly fortunate one. It has been proved, not only here, but also in many universities and scientific institutions, that research and teaching are of mutual service. A certain amount of teaching is stimulating to the investigator, while the atmosphere of research is indispensable to good teaching.

When the Laboratory was first established instruction was given in Zoology only, since then courses have been added in Botany, Embryology, Physiology and it

is understood that Comparative Psychology and Nature Study will form a part of the regular program hereafter. In these courses there is an earnestness and enthusiasm on the part of students and instructors which is highly stimulating. This is due not only to the exceptional character of the students and instructors, but also to the atmosphere of investigation which prevades the place and which is one of the most helpful features to the beginner, as well as to the advanced worker. Instruction includes not only ordinary laboratory work in the subject named, but also a great deal of observation and collection of living organisms in their natural haunts. Collecting trips and excursions form a regular part of the work, and a most important and enjoyable part. Investigators and even visitors at the Laboratory cheerfully contribute to the work of instruction, and so it generally happens that the lectures are given by men who are specialists in the subjects under consideration and who are able to teach with the enthusiasm, accuracy and directness of 'those having authority.' When it is remembered that the persons in attendance at the laboratory are almost without exception teachers, the tremendous influence of the Laboratory on the teaching of Biology in the schools, colleges and universities of this country can be surmised.

FIG. 4. A Collecting Trip; Launch and Schooner in the Background.

In 1891 a Supply Department was opened at the Laboratory for the purpose of furnishing to schools and scientific institutions various kinds of biological material to be found in the vicinity of Woods Holl. The collectors studied the best methods of preserving material, the habitats and breeding seasons of various animals, etc., with the result that the Supply Department has been not only a great financial assistance to the Laboratory, but that it has still further contributed to the scientific purposes for which the Laboratory was established. At present a skilled collector is employed the year around and material is gathered, not only from the vicinity of Woods Holl, but from far distant points.

But it is in the work of investigation

that the Laboratory has won greatest renown. The eminent scientific standing of the Director and his co-laborers has served to attract investigators from all parts of the land, until the Woods Holl Laboratory is to-day the Mecca of American biologists and is well and favorably known throughout the world. The list of original contributions which have proceeded from the Laboratory during the past twelve years numbers about three hundred; many of these are large monographs, illustrated with numerous colored plates, and some of them represent unique lines of research. For example, the study of 'cell-lineage,' as it has been called, had its origin at the Woods Holl Laboratory and has so far been confined almost entirely to that institution. This work consists in tracing the cleavage cells, into which the developing eggs of all animals divide, through the whole development until they give rise to larval or adult organs, such as the brain, nerves, sense organs, glands, alimentary canal, etc. This is in all cases a difficult task, frequently taking years of the most painstaking labor, but its results have been of fundamental and far reaching importance. Thanks to this work we now know the cell-lineage of about a score of worms and mollusks. This work has shown that from their first appearance certain cleavage cells are destined to give rise to certain organs; it has shown that, in the groups mentioned, cleavage is as constant in its character as are adult features; that in animals so widely separated as flat-worms, annelids and mollusks these early divisions of the egg are almost identical and that many corresponding cleavage cells give rise to homologous organs. Incidentally such work has shown the close genetic relationship of the groups named; it has also set a new pace in embryology. Now that we know the exact cell origin of these layers and organs, it will never again be possible in describing the development of these animals to refer the origin of certain organs to 'germ layers' merely, nor to refer the origin of these layers to certain general regions of the embryo. The importance of this line of work, not only in the study of the groups named, but also to the science of embryology as a whole, is fully recognized both in this country and abroad, and the credit for this service belongs in large part to the Woods Holl Laboratory.

Other work of the greatest importance has been done in the line of what has been called 'physiological morphology.' It would exceed the limits of this article to give even a brief description of papers of this class which have issued from the Laboratory. A few of the more striking lines of work, however, must be mentioned. Much attention has been given to experiments on the regeneration of lost parts in various animals. In hydroids, sea-anemones and worms these parts are sometimes reproduced in a normal manner, while under different conditions a head may be caused to develop where a tail belongs or *vice versa*. Another line of work has been the grafting together of different parts of animals. One member of the Laboratory succeeded in grafting together in almost every possible manner the pupæ of different moths and butterflies. Some of these afterwards went through the metamorphosis and came out as 'Siamese twins,' 'tandems' with four wings, etc. Another line of work, even more important, is found in 'experimental embryology.' In one famous experiment performed at the Laboratory, the eggs of the sea-urchin were artificially fragmented before they began their development, and in this way twins, triplets, or still more numerous larvæ might be produced from a single egg. If the fragments of the egg were entirely separate, the larvæ which developed were separate and perfect, if they were united, the larvæ were

united forming all kinds of double or multiple monsters. Other experiments have shown that certain salt solutions will cause unfertilized eggs to develop for a short time in an irregular way, and only last summer Professor Loeb discovered that he could cause the unfertilized eggs of the sea-urchin to develop into normal larvæ, in short, could produce artificial parthenogenesis in a phylum in which it has never before been known, by treating them with certain salt solutions; this is certainly one of the most remarkable biological discoveries of recent years. The lines of work outlined above, together with many which could not here be mentioned, and which have been actively prosecuted at the Woods Holl Laboratory, have been substantial contributions toward the solution of some of the most fundamental problems of biology.

Each year a course of general lectures on various phases of biological work is given by different members of the Laboratory and by distinguished visitors. These lectures are usually brief accounts of important investigations, presented in a popular form. A volume of these lectures is published annually and the contents of the volumes form a brief index to the multifarious activities of the Laboratory in research. These volumes are not only important contributions to knowledge, but still more, they are brief and popular presentations of what are often abstruse and difficult subjects, and as such they appeal strongly to investigators, teachers and general readers who have not the time to go more fully into these subjects. As showing the opinion of the outside world with regard to these lectures, the following is quoted from *Natural Science*, December, 1899: "Every biologist who is still young enough to be enthusiastic, looks with eagerness about this time of year for the arrival of the volume of 'Biological Lectures' from the Marine Biological Laboratory, Woods Holl, Mass. * * * One cannot help feeling that the intellectual atmosphere of Woods Holl must be bracing, the lectures are so vigorous. The charm of these lectures may be partly due to the circumstances of their delivery, but it is doubtless mainly due to the fact that each is an expression of personal work and personal interest. One cannot but be grateful to the Laboratory at Woods Holl, which has been the stimulus of the fine series to which this volume is added, *Floreat Woods Holl.*" In addition to the volume of lectures there is also published under the auspices of the Laboratory the *Biological Bulletin*, as well as the Annual Reports and Announcements.

The service which the Laboratory has rendered to biological instruction in our schools and colleges and to advanced work in biology in general is incalculable; it is the biological clearing house of this country, where the specialist who has been unable to keep up with the general advance of his science may learn from others what has been transpiring in fields outside his own, where teachers may exchange ideas as to the best methods of instruction, where distinguished men in various fields come to know each other in the most intimate and helpful way, and where all may get broader and truer ideas of the great problems of biology. The Laboratory is also a place to which schools, colleges and universities are coming to look for good men. This feature has never before been emphasized and it receives no direct attention at Woods Hall, but if the indirect influence of the Laboratory in discovering good men and placing them in good positions were known, it would be seen that this feature is no small part of the service which the Marine Biological Laboratory renders to American biology.

The confidence of the Director that the Laboratory would not fail to receive the support of the schools, colleges and univer-

sities of the country has been fully justified. During the past twelve years representatives from about three hundred schools and higher institutions of learning have been in attendance at the Laboratory, while twenty-seven colleges and universities and three societies have been regular subscribers to Rooms and Tables. The Laboratory has now grown to such proportions that it cannot expect to draw any large part of its financial support from educational institutions, already overburdened. It is itself an educational and scientific institution of highest rank, and however measured, deserves to stand alongside the best scientific schools and laboratories of the world. "It is acknowledged that only one similar institution in the world (Naples) is more productive in original research, and no other offers even approximately equal advantages for instruction." Such an institution deserves and expects independent support.

The present financial condition of the Laboratory is shown by the following figures:

Total Assets.

Estimated value of real estate, buildings and equipment at Woods Holl	$35,000.

Invested Funds.

General Endowment	$ 4,553.
Lucretia Crocker Fund	2,500.
Library Fund	866.
Interest on hand	230.
	$43,149.

Total Liabilities.

Mortgage on Woods Holl property	$2,900.
Unsecured Loans	5,276.
	$8,176.
Assets less Liabilities	$34,937.

The total earnings of the laboratory as compared with its expenses are given herewith. ('Earnings' include all sources of income save donations only; 'expenses' include all disbursements save those for land, buildings and permanent equipment.)

Total Donations	$37,730.
Earnings	$47,919.
Expenses	$50,759.

It appears from this statement that the income of the Laboratory, like that of scientific and educational institutions in general, is scarcely sufficient to meet the running expenses, and that it must look to the donations of interested friends for assistance in meeting a small annual deficit and for all permanent equipment and enlargement. This is a fact which requires no apology; the Laboratory is not a commercial enterprise but a charitable institution, in the same sense that colleges and universities are such. It is not the purpose of the Laboratory to make money, but rather to contribute as much as possible to the advancement of science, and in this respect it has fulfilled the highest hopes of all its friends. There is every reason to be proud of the fact that it has accomplished so great a work on so small a financial basis, and that it is at present so nearly self-supporting as it is.

The Trustees at their meeting in New Haven, December 29th last, resolved that for the best interests of the Laboratory the out-standing debt of $8,176, should be paid off at once and that a small cash balance should be left in the hands of the Treasurer. They, therefore, appeal to the friends of the Laboratory to contribute $10,000 to this end. Subscriptions may be sent to the Treasurer, D. Blakely Hoar, 220 Devonshire Street, Boston, or to any member of the Board of Trustees.

The time has come also when to give the Laboratory the stable and permanent character which it deserves it should be liberally endowed. Where could a better investment be made than in a scientific and educational institution with such a history behind it and such excellent prospects before? The Laboratory and the ideals for which it stands must not be allowed to suffer for lack of support; it must not remain standing where it is, for although its success has been remarkable, it is only the be-

ginning of what it should and could do, if properly supported. The aim of those who are interested in its welfare is to create a permanent station with adequate endowment and equipment which shall be in the future yet more than in the past 'a national center of research in every department of Biology.'

For this end its friends labor and wait, hoping that the time is not far distant when generous friends of science and education will see its needs and its opportunities and will not be slow in their response.

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*REPORT ON THE INITIAL WORK OF THE STATE GEOLOGICAL SURVEY OF NEBRASKA.**

IN a State such as Nebraska where there is no 'mineral'—a term which in the west has come to mean gold and silver-bearing—it is difficult to convince the masses that there is the least possible economic importance in a State geological survey.

If 'mineral' did occur, apathy could much more easily be overcome, and the appeals for a survey would find more willing and receptive ears. But something stronger than apathy is encountered in the prejudice which has been engendered against a State survey by men who have sought heretofore to establish such for the evident purpose of holding office, that is make a political job of it. This prejudice seems justifiable, nevertheless it is none too easy to live down. A good many years have passed since our admission to Statehood, yet Nebraska, a commonwealth greater than all New England, has never made an allowance of any kind for a State survey, not even for the postage and stationery used in correspondence. Literally then not so much as one cent has ever been voted for such work to date. Even moral support has been withheld, save that the titles Acting Botanist, Acting Chemist and Acting Geologist have been conferred. The title being the sole emolument of office. However, the preliminary work of a survey, which has engaged the writer's attention for successive summer vacations since 1891, has just received from the University of Nebraska encouraging recognition, and an allowance, which, though small, is substantial. For the biennium of 1899 and 1900, $1000 was allowed by the Board of Regents for the initial work of a State geological survey. The same sum was likewise allowed for a botanical survey. The sum of $500 a year may seem ridiculously small, yet it made it possible to undertake several lines of work, and fair progress may be reported. Camp outfits were obtained for several field parties. Team and camp accoutrements were procured for Mr. Cassius A. Fisher, a Fellow in the department of geology, who, together with Mr. W. H. H. Moore (U. of N., 1900), constituted a party whose summer was to be spent in examining gravel pits, clay pits, quarries, the water supply, and geology of the southeastern or Carboniferous counties of Nebraska. At each quarry, pit and exposure photographs were taken, measurements and sections made, notes recorded, and liberal samples taken from the soil and sub-soil down through every layer.

One hundred and fifty localities were thus examined. The specimens from each quarry are being mounted in order upon large wooden tablets properly made and finished, each some 7 feet high by one foot wide; these as done are placed permanently on exhibition to illustrate the rock and clay resources of the State. A second party in charge of Mr. C. N. Gould (a Fellow in the department of geology), with Mr. Roy Hadsel (S. W. Kan. College, 1899), as assistant, was provided with team and camp outfit, and drove from Oklohoma through

* Paper read before the Nebraska Academy of Sciences, December 1, 1899.

Kansas, Nebraska, northwestern Iowa into South Dakota, following the Dakota Cretaceous, the great water-bearing beds of the plains. Over one hundred boxes of material were collected, with the result that new forms were found, some valuable rock-bearing beds located, and the second or third largest known collection of Cretaceous leaves made, numbering 4000 to 5000 specimens. Mr. Gould is devoting his undivided energy to these collections, working them out, recording and numbering them, classifying and describing them. This work is to be finished by July 1, 1900.

A third party consisted of Mr. G. E. Condra, a graduate student of the University of Nebraska, who spent the spring and summer collecting the fossil Bryozoa in the Carboniferous exposures, with the result that some 30 localities were visited and a large collection made, in which are already represented over 40 species, several forms being undoubtedly new. Mr. Condra will spend the remainder of the year upon his collections, preparing the material, numbering, recording, identifying and describing the same. Numerous microscopic sections are already cut, and as many more are to be prepared, and this work which was begun two years ago will be continued for at least another year before a paper is to be presented.

A fourth party, consisting of Miss Carrie A. Barbour, assistant curator of the State Museum, and an assistant, visited quarries in the Carboniferous, and Permian for the sole purpose of collecting fossils. Over 20,000 of the commoner species were procured, some of them apparently new to the State, with three or four species supposed to be undescribed. A fifth party consisted of the acting State Geologist, who visited all quarters of the State, and attempted to correlate work as far as he was able. There is such an accumulation of data and material that it will tax the department to dispose of it in time to begin the work of 1900. Besides, several lines of investigation are under way, the most noteworthy of which is that of Mr. W. W. H. Moore, who is making freezing and pressure tests of the mortar, cement and building rocks collected during the summer. This investigation bids fair to yield some useful if not important results. It is the intention that every line of work and investigation shall be so well finished and so nearly in hand that there will be little or no overlapping of the work of one year upon the next. It may be reported that the initial work of the survey seems to be as well systematized as is to be expected the first year. Barring unexpected difficulties and adversities, it seems assured that fair progress may be reported to this academy at the close of the present biennium.

Another sum of $500 will be available for a continuance of the work in 1900, and not less than five or six papers will be ready to submit to the Legislature, as the result of the work of the first biennium. The plan being to ask for a special appropriation for publishing. These papers, according to present intention, will be confined studiously and strictly to economic phases of our geology, with the hope and full expectation that a legislative as well as a university appropriation may be a reality for the second biennium.

Erwin Hinckley Barbour.
The University of Nebraska.

SCIENTIFIC BOOKS.

Text-Book of Vertebrate Zoology. By J. S. Kingsley, Professor of Zoology in Tufts College. New York, Henry Holt & Co. 1899. 8vo., pp. viii + 439. 378 figures in text.

Professor Kingsley has prepared a text-book for college students "intended," so says the preface, "to supplement both lectures and laboratory work and to place in concise form the more important facts and generalizations concerning

the vertebrates." The first half of the four hundred odd pages of text is taken up with an account of the morphology of the vertebrates, while the second half is devoted to a systematic review of the group.

In the first half an introductory four pages defines and illustrates the group of chordates and the position of the vertebrates in the group. There follow four pages of introductory embryology, dealing in the briefest and most generalized way with the pre-embryonic stages of development, and then eight pages of general histology.

The organs of vertebrates are then considered under the four heads of entodermal, ectodermal, mesothelial and mesenchymatous organs. The discussion of each is from the embryological standpoint, but includes a consideration of its adult structure. The space given to an organ is necessarily very little, to the teeth two pages, to the tongue half a page, to the cranial nerves eight and one-half pages. This part of the book closes with an account of the segmentation of the head, followed by a brief account of the early development of the egg of vertebrates (oögenesis, spermatogenesis, cleavage, gastrulation) and by a section on the origin of the vertebrates. If one should weave into a single account greatly condensed resumés of Wiedersheim's 'Comparative Anatomy' and Hertwig's 'Text-Book of Embryology,' the result would be very much that which we have here, though Professor Kingsley's combination is skillfully made, clear, generally accurate and brought up to date.

The author is to be congratulated on having the courage to give due recognition in the second part of his book to the importance of a knowledge of vertebrate classification. It is further a matter of congratulation that fossil forms have been included. The treatment is the usual one and this part of the book in its arrangement and general typographical make-up reminds one strongly of Sedgwick's translation of Claus's elementary text-book. It is not to be expected that Professor Kingsley has pleased every one in the matter of classification, that he has prepared a concise and useful summary few will question. Families are briefly characterized; important genera are mentioned; in some cases habitat and common names of genera are added, in other cases only the scientific names appear. But few specific names are mentioned. It is unfortunate that the plan of the book renders this part of it so brief. For purposes of identification it cannot be of great use, but as a convenient means of referring generic names to their families it is of distinct value, and hence the mention, merely, of many generic names is to be commended.

That a book meant for college use should omit references to the literature is a serious blemish.

The index, unfortunately, includes the anatomical and embryological references for the first part of the book only, and the taxonomic terms for the second part only. Thus Cladoselache is referred to page 237, but not to page 173. Even taxonomic terms used in the introductory sections of the systematic part of the book are not fully indexed. Thus Notodelphys is referred to page 287, but not to page 281, where it also occurs; while Rhinoderma, which occurs on the same page, is not indexed. This should be corrected in a later edition.

Among many old friends we find some excellent new illustrations, and many that are rough sketches. Particularly noteworthy are the very useful perspective diagrams, such as Fig. 127. Why, on the other hand, Fig. 16, should be thought worth printing, when so many excellent figures are available, is a mystery. The reproduction of the original figures is frequently bad, the reference lines and letters being often blurred, the latter sometimes illegible. (Figs. 34, 39, 85, 159, 283.) The copied figures are excellently rendered and in other respects the work of the publishers is well done.

Detailed criticism is perhaps superfluous where so much is good, but one wonders how Professor Kingsley overlooked this (p. 25) with reference to the air bladder of the fishes: "The bladder itself usually lies dorsal to the aorta and urinogenital system next the vertebral column." Does not every fisher-boy know better? That archenteron and stomach are synonymous terms, as implied on page 6, and that the duodenum is pre-hepatic, as one might infer from reading the statement at the bottom of page 35, are statements needing revision.

The style of the book is on the whole simple and clear (what does the subject-matter admit of else?), but one is occasionally startled by such English as this (p. 38): "In birds, at about the middle, the mid-gut bears a blind tube," or as this (p. 223): "The lampreys feed upon the mucus and blood which they *rasp* from fishes."

The method of treatment is then strictly morphological—the first part dealing with the morphology of the organs—the second part adding to this so much of external morphology as is of use in classification. Judged as a morphology the book deserves to be commended. But does this warrant the author in calling it a zoology?

A categorical description of the structures of vertebrates so arranged as to suggest their evolution is but a part of zoology. In the opinion of the reviewer it is the least interesting part, and by many modern workers it is regarded as the least important. It would be hard to imagine a college student calling Professor Kingsley's book either interesting or stimulating, though if used as directed in connection with lectures and laboratory work he will surely find it of value. It is easier to point out faults than to show how they may be remedied, but why, may we ask, should three pages be given to the mouth, lips, teeth and tongue, and no word said of the chain of causal relations connecting lip development in mammals with the power of mastication, heterodont dentition and articulate speech, so admirably worked up by Gegenbaur? Why an account of the peculiarities of structure of the Raiæ and no word as to the relation of these peculiarities to the mode of life? And so the rest of it: if we are to have pure morphology, why not more of the spirit of Gegenbaur and less of that of Haeckel? When the ideal text-book of zoology is written it will surely deal with causes, not merely with results.

Jacob Reighard.
University of Michigan.

Water-Supply Engineering: The Designing, Construction and Maintenance of Water-Supply Systems, both City and Irrigation. By A. Prescott Folwell, Associate Professor of Municipal Engineering in Lafayette College. First Edition. New York, John Wiley and Sons. 1900. Octavo, 562 pages and 19 plates. Price, $4.00.

The Filtration of Public Water-Supplies. By Allen Hazen. Third Edition, Revised and Enlarged. New York, John Wiley and Sons. 1900. Octavo, 321 pages and 22 plates. Price, $3.00.

It is a happy feature of American engineering education that many of the text-books used by the student are also manuals constantly consulted by the engineer in making his designs. In such a system of education there is no conflict between theory and practice, but each supplements and improves the other. Theory is indeed merely the systematic formulation of general laws derived from experience, and practice is the application of theory to the economic production of useful results. Both of the above books are well adapted to class use, both exhibit the details of the latest theories and constructions, and both are of high value to the practicing engineer. The first book covers the wide field of all the features of water works, while the second treats of that special part concerned with the improvement of the quality of the water.

Professor Folwell has succeeded well in presenting the principles and practice of this wide field in a single volume. The theoretical discussions may sometimes be criticised as rather incomplete, but it is evidently intended that the reader should have a good knowledge of applied mechanics and hydraulics. The question of the force of impact caused by a moving body or stream of water, which is always puzzling to practical men, especially needs correction and revision on pages 229 and 247. On the whole, however, the theory seems as well presented as can be done in such limited space. The practical details relate largely to the water supplies of cities and towns, irrigation systems being properly given a subordinate place. The subject of designing which includes quantity and quality of water and the details of the systems of collection, purification, and distribution, covers 452 pages, while construction and operation are treated in 94 pages. Methods of cleaning water mains, of thawing out frozen

pipes, and of preventing corrosion from electrolysis are well discussed. Pumping systems are treated more fully than usual; this is a step in the right direction, since about 75 per cent. of the water works of the United States are operated by this method, the gravity systems being largely confined to the large towns on the Atlantic and Pacific States. The growing importance of water-supply engineering may be clearly recognized from the fact that the number of water works in the United States in 1898 was about 1600, while in 1897, it was about 3200. The book is well illustrated, clearly written, and will be a valuable aid to all who are planning or operating public water supplies.

The increasing interest in securing purity of water-supplies is not only evidenced by the circumstance that the book of Mr. Hazen has reached its third edition in less than four years, but also by the construction of sand filter beds at seventeen American towns and cities in the last decade. During the same period more than one hundred others have installed mechanical filtration plants. No fact in sanitary engineering is, indeed, more fully established than that the death rate from typhoid fever is materially lowered by filtration, and the present interest of the public gives hope that the time is not far distant when the cities of the United States may take rank with London, Berlin, Vienna, and Amsterdam in freedom from that disease. Mr. Hazen is a high authority on this subject, and, although an advocate of the system of slow filtration through sand beds, his book treats also of the more rapid system of mechanical filters, which in many cases may be installed at less expense. The present edition gives the results of the recent experiments at Louisville, Pittsburg, and Cincinnati, and also valuable information regarding the filter beds of several European cities. Statistics of both systems of filtration are presented in tabular form. These show that the slow sand system is used by cities having an aggregate population of 21,400,000, of of which 10,200,000 are in Great Britain and 260,000 in the United States. The aggregate population using mechanical filters in the United States and Canada is nearly 1,600,000, while this system is practically unemployed in other countries. At the present time only about one-tenth of the cities and towns of the United States have filtered water supplies. The book of Mr. Hazen, as well as the large plant recently built at Albany, N. Y., under his supervision, will have much influence in inducing other cities to inaugurate effective methods for the purification of their water supplies.

MANSFIELD MERRIMAN.

California Mines and Minerals. Published by the California Miners' Association, under the direction of EDWARD H. BENJAMIN, Secretary for the California Meeting of the American Institute of Mining Engineers. San Francisco, Calif. 1899. Vol. 8. Pp. 450.

This treatise upon the mines and mining of California is dedicated to the members of the American Institute of Mining Engineers 'as a souvenir of their visit to California' in September and October, 1899; but it is a vastly more important and valuable work than the usual 'souvenir.' It constitutes a very valuable treatise upon the great industry to which it is devoted and is full of important information, valuable historical facts and industrial statistics. It is a large volume, handsomely printed, extensively and well illustrated, well made and substantially bound. Its market value is stated to be five dollars and the munificence of the Californian is well exhibited in the fact that a copy was supplied to every member of the visiting Society.

The contents consist of thirty-five papers by well-informed writers and often the ablest in their respective departments. In these chapters are described the topography, geology and mineral deposits of the various mining counties of the State, the methods of working, the statistics of production, and the special conditions of exploitation and development of the more interesting fields, especially those in which the precious metals are produced in largest quantity. Regarding the most important products, gold and silver, copper, borax, bituminous and asphaltic rock, quicksilver, and petroleum, the ground is remarkably well covered. We note that the output of silver has less value than that of petroleum and that quicksilver has fifty per cent. larger value than the former.

Numerous half-tone and other illustrations, maps and tables of statistics aid the reader in obtaining a most satisfactory understanding of the extent and importance of the mining industries of California.

R. H. T.

BOOKS RECEIVED.

Richter's Organic Chemistry. Edited by Professor R. Anschütz. Translated by Edgar F. Smith. Third American Edition. Philadelphia, P. Blakiston's Son & Co. 1900. Vol. II., pp. vi + 671. $3.00.

Malay Magic. Walter William Skeat. With preface by C. O. Blagden. London and New York, The Macmillan Company. 1900. Pp. xiv + 665. $6.50.

Lessons in Elementary Physiology. Thomas H. Huxley. Edited by Frederic S. Lee. New York and London. 1900. Pp. xvi + 577.

The Teaching of Elementary Mathematics. David E. Smith. New York and London, The Macmillan Company. 1900. Pp. xv + 312. $1.00.

SCIENTIFIC JOURNALS AND ARTICLES.

The Plant World for February has for its leading article 'Notes on the Edible Berries of Alaska,' by Walter H. Evans, who states that they are of wonderful abundance and variety. John M. Coulter treats of the 'Geograpical Distribution of Conifers,' Byron D. Halsted presents a note on 'Coloration of Leaf for Seed Distribution,' and K. C. Davis discusses the 'Wild and Garden Pæonies in America.' Mrs. Caroline A. Creevey continues her series of articles on 'Plant Juices and their Commercial Values,' amber, copal and turpentine being among those discussed in this number. The Supplement on 'The Families of Flowering Plants' contains the Ginkgoales, the Pinaceæ and the Taxaceæ.

SOCIETIES AND ACADEMIES.

GEOLOGICAL SOCIETY OF WASHINGTON.

The 97th regular meeting was held at the Cosmos Club, February 14, 1900.

Under informal communications, Mr. Bailey Willis stated that a diamond drill hole at The Dalles, on the Columbia River, had reached a depth of 916 feet and had penetrated several flows of Columbia basalt, distinguished by layers of clay and by differences of texture. No exact section has been kept. A piece of core from 916 feet in depth is shown by examination in thin section to be basalt. The object of the boring, which is a private enterprise, is to prospect for coal.

Mr. H. W. Turner proposed the adoption and use of the term *Sierran*, originally suggested by Professor Le Conte, to distinguish the erosion interval of the early Pleistocene. The actuality and importance of this early Pleistocene erosion were illustrated with reference to the eastern slope of the Sierra Nevada. It was shown that the *Sierran* cañons had in some cases been occupied by lava flows upon which the moraines of Glacial time are resting.

The following papers were presented on the regular program:

(1) 'A peculiar Clastic Dike and its Associated Ore Deposits,' by Mr. F. L. Ransome. This dike is exposed in the workings of the Wedge and Bachelor mines, near Ouray, Colorado. It fills a normal fault-fissure, of small throw, cutting nearly horizontal beds of sandstone and shale. The filling material came from above, and is largely composed of flakes of black shale, derived from a bed which is traversed by the fissure, but which limit the upward extension of the dike. This material was subsequently forced by pressure into all the branches of the fissure and has the form of an eruptive dike. It has been explored to a depth of 630 feet and has an average width of 2 or 3 feet. The ore, which is an argentiferous tetrahedrite, or freibergite, occurs alongside of, or in the dike, in spaces opened by later movements. These have been in part bedding faults, which have dislocated the dike along nearly horizontal planes.

(2) 'Wood River Mining District, Idaho,' by Mr. Waldemar Lindgren. The silver-lead mines of Wood River are located in southern central Idaho, some 50 miles north of Snake River. The geological formations consist of a sharply folded series of Paleozoic, probably very largely Carboniferous, sediments consisting of limestones, quartzites, and slates. Imperfect fossils indicating Upper Carboniferous were found in it at two localities. The large granite area of southern Idaho abuts against the sedimentary

rocks in this vicinity, showing at the contact undoubted intrusive phenomena. The Carboniferous series contains several isolated masses of granitic rocks of varying character, which are also intrusive into the sediments.

The deposits are fissure-veins with a west to northwesterly strike and southerly dip, occurring, as a rule, in the calcareous shales of the sedimentary formation. The principal minerals are galena and zincblende in a gangue of predominating siderite. Veins of the same character are also found in the granite areas enclosed in the sediments. The veins are pre-Miocene and post-Carbonifereus in age, their crossings being in part covered by andesitic flows. The granitic rocks also contain another series of veins of very different composition. They carry chiefly gold contained in pyrrhotite, chalcopyrite, pyrite, and arsenopyrite. Replacement has played an important part in the vein formation, especially in those veins which are contained in the sedimentary areas. The fissure plans are well defined but the ore-bodies do not follow these strictly in detail, and may exhibit considerable irregularity.

(3) 'Cretaceous fossils collected by J. B. Hatcher in Patagonia,' by Mr. T. W. Stanton. Among the collections brought back by Mr. Hatcher's last expedition to Patagonia there are some Cretaceous invertebrates that seem to represent a fauna new to South America. The localities from which they were obtained are near Lake Puerrydon in Latitude 47° 30′ S. and Longitude 72° W. There are about 35 species in the collection of which 28 are sufficiently well represented to be described and these all appear to be new. Although there are some indications of relationships with Lower Cretaceous faunas, consideration of the collection as a whole leads to the conclusion that the horizon is about the middle of the Cretaceous, at least not lower than the Gault.

F. L. RANSOME,
DAVID WHITE,
Secretaries.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 318th meeting was held on Saturday, February 10th. H. J. Webber exhibited photographs of the Melon Pawpaw, *Carica papaya*, which is a native of both the East and West Indies. The form native in Florida has a fruit about the size of an egg, but the cultivated varieties (of which there are several) bear fruits from the size of a small musk melon up to five or ten pounds in weight. The fruit is pyriform and much resembles a musk melon in taste and make-up and is sliced and eaten in the same way.

The most noteworthy character of the plant is its well known faculty of rendering meat tender when cooked with it. This is due to the presence of a soluble ferment known as papain which is similar in action to the animal pepsin. The fruit of *Carica* also contains this ferment in considerable quantity and bids fair to become a very valuable desert fruit, especially for invalids troubled with indigestion. It is a fruit which should be more widely known and sold in all markets.

Henry W. Olds spoke on 'Form in the Songs of Birds,' showing first that the study of bird music, while interesting, is of little, if any, value as an aid to the development of the science of ornithology. He then considered the question of the use of our scale. He gave a brief resumé of its evolution and stated that, wonderful as it seems, it is a fact that some of the birds do use our scale. He instanced several that unmistakably are governed by the intervals that compose it, although some of them occasionally wander from the key just as human singers do. Mr. Olds then considered various essential forms that give to music coherence and capability of æsthetic satisfaction. These he illustrated with blackboard notations and whistled examples of both human and avian music. He showed different means by which is produced that symmetry that is needed to satisfy the musical sense—the regular recurrence of phrases or kinds of phrases, repetition of one theme on different pitches, the regularity of these repetitions, antiphonal or answering themes, etc., and for every example in our music instanced its counterpart among bird songs he had noted. In conclusion he suggested that these were not accidental resemblances, but seemed to show on the part of the birds intelligent appreciation of musical effects; and that there appeared to be no

escape from the conclusion that the birds were subject to a musical evolution that paralleled our own.

Mr. M. G. Kains presented a paper upon 'The Effects of the Electric Arc Light in the Culture of Easter Lilies,' giving the results of experiments conducted during the winter of 1895, at Cornell University, under the direction of Professor L. H. Bailey. Three divisions of the plants were made, one in the full glare of the naked light, one in which the light first passed through a pane of glass, and one where no light was employed. The light burned nightly for four months and uniform cultural conditions were maintained throughout the tests. Plants in the light sections were taller, blossomed earlier, were less robust and their flowers shorter lived than those grown in the dark, blossoms in the naked light exhibited a dark brown burn upon the surface facing the lamp, and blossoms upon plants grown in the dark lasted two days longer than those in the light. From the experiments it is concluded that commercial use might be made of the arc light after the lily buds are an inch long, and that the light must pass through a glass to screen out the ultra-violet rays of the spectrum.

E. V. Wilcox discussed 'Lupines as Plants Poisonous to Stock,' saying that cattle and sheep varied greatly in their liking for the growing plants, some animals eating them with avidity and others caring little for them. The poisonous properties of the Lupines appeared to reside in the seeds or seed pods, for, while the plants were usually eaten with impunity, great mortality had been known to occur among stock which was forced by a fall of wet snow to feed on plants from which the leaves had mostly fallen while the seed pods remained. On the large ranges of the west, where forage plants were not cultivated, Lupines were frequently so abundant that they were cut and dried like hay for use in winter, and the speaker noted a case where sheep fed on this Lupine hay were seemingly driven mad.

T. W. Stanton,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 512th meeting of the Society was held on February 3, 1900, at the Cosmos Club. After a general discussion on the method of publication of the *Bulletin*, the first regular paper of the evening was read by Mr. J. G. Hagen, on 'Recent Progress in Astro-physics.'

During the course of the address the following three points were discussed: *The cluster type* of *variable stars*, the *spectroscopic binaries*, and the *Potsdam photometric catalogue*.

Regarding the first point, the cluster Messier No. 5 was mentioned as presenting a remarkable uniformity in its variable stars. Out of 900, visible on the plates obtained in Arequipa with the 13-inch Boyden refractor, 63 were recognized as variables, and 40 of them were measured accurately from nearly a hundred plates. The mean period of all except two is about 12½ hours, with a mean range of 1.1 magnitude. It was suggested that, with Pogson's light factor 0.4, the common range of 1.1 magnitude could be explained by supposing each variable to be a binary system, with components of equal brightness. The cluster would then consist of many binary systems, each with its orbital plane passing through the sun, and with a period of revolution equal to 25 hours.

With respect to spectroscopic binaries, Campbell's discovery of Polaris as a double system was mentioned. The center of gravity approaches our sun with a velocity of 12 kilometers, while Polaris oscillates around it in a period of about four days. The fact that three years previous the mean velocity was found eight kilometers larger, might point to a disturbing body. Yet, to pronounce Polaris a triple system, would be premature. Another interesting discovery of a periodic change in the spectrum was recently made by Mrs. Fleming in the case of Zeta Centauri, with intervals of two and six days, thus making a period of eight days. The intervals of two and six days were graphically illustrated by an eccentric orbit. Attention was also called to experiments made by Humphrey, Mohler and Wilsing, to the effect that changes in the normal spectrum may be produced by changes of pressure in the source of light.

The third point consisted in a summary of a review of the Potsdam photometric catalogue, recently published in the *Vierteljahrsschrift*, XXXIV., pp. 288–297.

At the close of the paper two Goerz Trieder Binoculars were exhibited.

The second paper read was by Mr. J. F. Hayford, on 'Recent Progress in Geodesy.' As it is expected that this will soon be published in SCIENCE in full, no abstract is here given.

A paper by Mr. T. J. J. See, on 'Recent Progress in Astronomy,' went over to the next meeting on account of the absence of the author.

E. D. PRESTON,
Secretary.

TORREY BOTANICAL CLUB.

THE annual meeting on January 9th, resulted in the election of the previous board of officers, including as *President*, Hon. Addison Brown; *Treasurer*, Maturin L. Delafield, Jr.; *Secretary*, Edward S. Burgess, Ph.D.; *Editor*, Lucien M. Underwood, Ph.D. Annual reports of officers were rendered, that of the Treasurer showing a balance in the treasury.

The Secretary, Professor Edward S. Burgess, reported an average attendance of 31 at the 15 meetings held during the year, one death, a present active membership of 237, corresponding membership 142, honorary membership 3, total membership 382. Among the 18 scientific papers presented, 5 had been accompanied by lantern views; 4 papers related to ferns. Nine illustrative exhibits of photographs, plates and flower paintings, etc., had been held. Brief reports of collections and of botanical progress numbered 55.

The editor, Professor L. M. Underwood, reported the regular monthly issue of the *Bulletin*, forming the largest volume published to date, including 650 pages, besides 23 heliotype plates and 38 figures in the text, and including 65 articles representing 39 authors. The publication of the *Memoirs* has been carried on with unusual activity, including Dr. M. A. Howe's monograph on the Californian Hepaticæ (208 pages, 35 plates), Mr. Tracy E. Hazen's Life-history of '*Sphærella lacustris* (*Hæmatococcus pluvialis*'), pp. 33, 2 colored plates, and the beginning of Professor F. E. Lloyd's 'Comparative Embryology of the Rubiaceæ' (pp. 21, 4 plates).

Miss Ingersoll, as curator, reported upon the condition of the herbarium of the Torrey Club, suggesting its transfer to the New York Botanical Garden. Discussion followed looking toward its treatment there as the nucleus for a distinct local collection, but no definite action was taken. Dr. T. F. Allen remarked upon the beginnings of the collection as dating from a persistent botanical exploration of parts of New Jersey, especially about New Durham and the Secaucus swamps, made by himself and Mr. Wm. H. Leggett, Dr. Bunstead, etc.

Dr. Allen's own private herbarium at Litchfield, Ct., is also richly representative of those localities and others now destroyed or altered, and contains much of interest to the history of local botany of New York City.

Miss Marie L. Sanial, as Secretary of the Excursion Committee, reported 38 excursions held, with the new feature of excursions for bryological and other collections in December, at one of which 15 persons were present.

The Committee appointed to consider a program for a Torrey Day in connection with the A. A. A. S. meeting here next summer, reported through the Secretary, a provisional program.

The scientific paper of the evening was by Professor Francis E. Lloyd, on 'The Relationships of certain Rubiaceæ,' forming part of an investigation in the embryology of that order now in course of printing among the *Memoirs* of the Torrey Club. The ground of relationship considered was the ovary, which is classed as inferior, but developmentally proves a receptacle hollowed out. The flower seems to be derived from one or more separate corolla-lobes. The Rubiaceæ are very polymorphic externally, and there is the greater need of discovery of stable internal characters. Such characters for the ovary of the Stellateæ were discussed in detail. That of the common Buttonbush, *Cephalanthus*, was alluded to as possessing certain ovary characters in form and relatively rapid and prolonged growth of the basal partition, which accord most significantly with the unusually compressed position of the ovary.

Discussion followed regarding the passage of pollen tube through tissues rather than loosely in the cavity of the ovary. In some Rubiaceæ, said Professor Lloyd, these tubes seem stimulated by contact with the enlarged collar-cells of the funiculus, and appear to owe their

guidance into the micropyle to such stimulus. Dr. MacDougal remarked upon recent conclusions that pollen tubes show negative reactions to oxygen, but positive to sugars, and to albuminoid substances in the ovary or near the embryo-sac.

EDWARD S. BURGESS,
Secretary.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

THE February meeting of the New York Section of the American Chemical Society was held at the Chemist's Club, 108 West 55th street, on Friday evening, the 9th inst., Dr. C. F. McKenna presiding. After consideration of a series of resolutions submitted by the Committee on Standards for Instruments of Measure, the following papers were read: 'The Technical Analysis of Rope and Twine,' by Durand Woodman; 'A New Synthesis in the Phen-Miazin Series,' by Marston Taylor Bogert; 'On the History of Photo-Chemical Improvements,' by Maximilian Toch.

Dr. Woodman described the chief commercial grades of Cordage, 'oiled' and 'unoiled,' 'tarred,' 'plumbagoed,' etc., and exhibited samples of manila, sisal and jute fiber with analyses; also analyses of the different grades of rope above mentioned.

Dr. Bogert described a new method of preparing the salts of the Phen-miazin series as developed in the organic laboratories of Columbia University, which consists in heating anthranilic acid with any nitrile in a sealed tube for several hours at a temperature of 200 degrees to 250 degrees C., according to the nitrile used. Since many foreign chemists, as well as several in this country, are working on this same subject, it is very gratifying to have a successful result on a new line of experiment from the University in this city.

Mr. Maximilian Toch described chiefly the progress in photo-chemistry, and illustrated the method of printing and developing some of the more rapid bromide papers. His paper was listened to with great attention and was followed by remarks and reminiscences from several members

DURAND WOODMAN,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis of February 5, 1900, some 250 persons were given a demonstration of the use of the microscope in the sciences, arts and industries, by experts, under the direction of Dr. H. M. Whelpley, as follows:

Anatomy, Dr. R. J. Terry; *Bacteriology*, Dr. Amand Ravold; *Blood examination*, Dr. Ludwig Bremer; *Botany*, Mr. H. F. Roberts; *Diseases of forest trees*, Dr. H. von Schrenk; *Drug adulterations*, Mr. O. H. Elbrecht; *Flour inspection*, Mr. Victor Goetz; *Insects parasitic on man*, Mr. C. F. Baker, *Living protoplasm*, Dr. Otto A. Wall, Jr.; *Microphotography*, Mr. Robert Benecke; *Mineralogy*, Dr. G. Hambach; *Photographic dry plate testing*, Mr. Robert Benecke; *Photomicography*, Dr. Adolph Alt; *Physiology*, Dr. Hartwell N. Lyon; *Seed adulterations*, Mr. F. W. Maas; *Spice adulterations*, Mr. William K. Ilhart; *Textile fibers*, Mr. Peter J. Weber, Jr.; *Trichina*, Dr. G. C. Crandall.

Through the courtesy of the Historical Society, the rooms of that Society were thrown open to the members of the Academy and their guests, and the Society's important collections, as well as the demonstration offered by the Academy, proved a source of interest and instruction to the ladies and gentlemen present.

WILLIAM TRELEASE,
Recording Secretary.

NOTES ON PHYSICS.

DRUDE'S ANNALEN.

A NEW series (the fourth series) of the *Annalen der Physik*, begins with the current number, January, 1900, under the editorship of Paul Drude. This great periodical will now be known as *Drude's Annalen*. The third series, the *Annalen der Physik und Chemie*, edited by G. and E. Wiedemann, contains sixty-nine volumes. The entire series, 305 volumes to date, represents a large part of the progress of the physical sciences during the eighteenth and nineteenth centuries.

RADIANT HEAT.

PROFESSOR MAX PLANCK gives, in *Drude's Annalen*, January, 1900, a reprint of his electro-magnetic theory of radiation which was com-

municated to the Berlin Academy of Sciences in May, 1899. This memoir, which seems to be monumental in character, is remarkable in that it verifies the Stefan-Boltzmann law, derived from thermodynamic considerations, that the total energy radiant from a black body is proportional to the fourth power of the absolute temperature, and the law of W. Wien concerning the distribution of energy in the spectrum of a black body.

Wien's conclusions are based upon certain assumptions as to the number of radiant centers (molecules) in unit volume and their velocity. It is now known that the total energy radiated from a black body and its distribution in the spectrum depend only upon temperature and are entirely independent of the physical properties of particular substances, so that it is highly probable that the law of total energy and the law of its distribution in the spectrum are capable of rigorous derivation from assumptions of axiomatic simplicity.

The theoretical results of Stefan, Boltzmann and Wien, now verified by Planck, may, therefore, eventually appear to be independent of the highly specialized character of the assumptions upon which they are based. When this stage of the science is reached, these laws of radiation will no longer appeal to experiment for verification, but they will take their place among numerous other established laws as instruments for the interpretation of experimental results.

Physicists ought to drop the term radiant energy and retain the older and better term radiant heat, inasmuch as the energy of radiation is heat in the same sense that molecular energy is heat. Both types of energy are subject to the first and second laws of thermodynamics; both types give rise to the entropy function, and Maxwell's law of molecular velocity distribution is strictly analogous to Wien's law of the distribution of energy in the spectrum.

THERMAL CONDUCTIVITY.

HEAT measurements are among the most inaccurate of physical measurements and the measurement of thermal conductivity is perhaps the most inaccurate of the measurements in heat. Professor Kohlrausch (*Drude's Annalen*, January, 1900) proposes a method for measuring thermal conductivity which depends upon the final permanent distribution of temperature in a conductor carrying electric current, heat being allowed to flow out of the conductor only at the points where current enters and leaves it. Under these conditions a remarkably simple relation subsists between the temperature at a point, the electric potential at a point, and the ratio of electrical to thermal conductivity. The method depends only upon measurements of temperature, of electrical potential, and of electrical conductivity. W. S. F.

ENGINEERING NOTES.

A NUMBER of European nations are now adopting the Gruson chilled iron shield for their land defences and the success of the invention is so well-assured, it is said, that the Messrs. Krupp, some time since, bought the *Grusonwerke* and have developed the invention to a state of considerable perfection. The Gruson armor-turrets are thought to be practically invulnerable; their flatly curved tops deflecting shot and shell and their adamantine chilled surfaces and their great thickness making them impenetrable to direct impact of the heaviest shot. It is proposed to endeavor to introduce this device into the United States, where it is thought that it may be made even more successful, since our chilling irons are found to be superior to those of any other country. The turrets are usually of from 50 to 100 tons weight and are built up of great staves and segments, ten or fifteen of which constitute the low, wide, circular, covered box which constitutes the turret and protects the guns. The top is usually made of two semi-circular halves. In their manufacture, the quality of iron employed is presumably that found to make the best car wheels and one of peculiar strength and toughness, as well as of intensely hard chilling property. A *Grusonwork* is to be established at Chester, Pa., by New York and Philadelphia capitalists.

THE success of the submarine craft which have been recently produced in the United States and in France is stimulating other nations, and an authority among English technical journals—*Industries and Iron*—says: "In spite of the derision with which they have been

received by our Admiralty, there is a prospect of submarine torpedo boats, becoming an important factor in the future strategy of marine warfare. Apart from the ancient history of diving or submarine torpedo boats, the recent activity, notably of the French and American naval authorities, and the favorable views with which the experts of these two nations look upon the latest developments in submarine torpedo boats, is more than ample justification for our Admiralty giving serious consideration to this most dangerous and constantly improving mode of torpedo attack. Our battleships are estimated to be worth £40,000,000 and our protected cruisers about £26,000,000, whilst other fighting ships of our Navy are valued at about £34,000,000, making in all a grand total of £100,000,000. Surely if our costly Navy is to be menaced with such a system of deadly torpedo attacks as may reasonably be anticipated from the modern submarine boats of foreign naval Powers, it behooves our Government to test and adopt counteracting means of attack, and also to endeavor to secure some more reliable means of defence against such attacks than at present obtain in our Navy."

The last year was the 'record year' for Great Britain as well as for the United States. That country registered a foreign trade totaling about four thousand dollars. The imports were £485,000,000, of £12 per capita of total population, the exports £264,000,000, about £6 // 11s, per capita and the re-exports £65, averaging £1 // 12s. There has never been a year in which so much trade was reported, so much manufacturing done or so much profit secured; notwithstanding the enormous amount of successful competition in the British market and the markets of the world, to which the United States and Germany have attained. Prosperity has been quite extraordinary in all manufacturing and exporting countries.

R. H. T.

BOTANICAL NOTES.

BOTANY AT WOODS HOLL.

For about a dozen years opportunities for botanical study have been offered to botanists at the Marine Biological Laboratory at Woods Holl, a seaside town on the southern coast of Massachusetts. Year by year the work offered has been enlarged, so that now, under the direction of Dr. B. M. Davis, of the University of Chicago, it includes a laboratory study of algæ, fungi, plant physiology, plant cytology and micro-technique, with lectures covering nearly the whole field of botany. The laboratories are open from July 5th to August 16th.

When we think of the poor preparation of so many of our teachers of botany in the high schools, and even the colleges and the so-called universities, it is strange that more of them do not take advantage of the opportunities offered by such a school as this at Woods Holl. It is encouraging to see that already eighteen colleges are coöperating in supporting this laboratory school. There should be many more of these. Every large institution should offer as a prize to its advanced men a room or table in the Woods Holl Laboratory. In many cases this would be of much more value to the recipient than a scholarship or fellowship costing the institution much more money. These might be called 'Woods Holl Scholarships,' the recipient to spend the season in work in the laboratory, and to bring back into his college at the end of the summer vacation the results of his studies.

MINNESOTA BOTANICAL STUDIES.

The thick 'part' of this interesting and unique publication which appeared early in January, contains articles on *Chlorochytrium* (an endophytic alga of the Protococcaceae, found in the thallus of a marine seaweed), *Rhodymenia* (a red seaweed from the Pacific Coast), the Lichens of the Lake Superior Region (enumerating one hundred and fifty-eight species and varieties, forty-six of which had not hitherto been recorded from the interior flora of the United States), Lichens of the Minnesota Valley (enumerating two hundred and one species and varieties of which forty-one had not hitherto been recorded from Minnesota, one being new to science), Synonymic Conspectus of Native and Garden Aquilegias of North America (describing forty-six species and varieties), Synonymic Conspectus of the Native and Garden Aconitums of North America (describing seventeen species and varieties).

HARPER'S STUDIES IN CELL DIVISION.

THE December number of the Annals of Botany contains another of those valuable contributions to plant cytology which have appeared from time to time from the hand of Professor Harper. He takes up in the present paper the cell-division in sporangia and asci, using for the former mainly the species of *Saprolegnia* and *Achlya*, with some of the *Mucoraceae* and *Synchitriaceae*, also. For the cell-division of asci he has made use of his previous studies in the *Erysipheae*, and now adds *Lachnea scutellata* of the *Pezizaceae*. His summary of results is in part as follows:

"If we compare now the methods of spore-formation in the ascus and in the sporangia studied, the differences in the two cases are at once apparent. In the ascus, as in the higher plants, the cutting out of the daughter cell from the mother cell is effected by the agency of the same fibrous kinoplasmic elements as were concerned in the division of the nucleus. In the higher plants the flat cell-plate is formed by the 'cone-principal' of the karyokinetic figure as named by Van Beneden, while in the ascus the daughter cell is cut out of the protoplasm of the mother cell by an ellipsoidal cell plate formed from the fibers of the antipodal cone. In this process the daughter cell is cut out of the interior of the protoplasm of the mother cell, so that it remains surrounded on all sides by the material of the mother cell. The daughter cells do not contain all the protoplasm of the mother cell, a considerable mass remaining as the so-called epiplasm. This is typical free cell-formation, as I have pointed out before. In all the sporangia studied, the cleavage is from the surface of the protoplasm, or from the surface of vacuoles of the mother cell. The daughter cells are thus separated by cleavage-furrows, and the nature of the division from the surface inwards precludes the possibility of the formation of an epiplasm. * * *

"If we consider now the bearing of the observations presented, on the doctrine that the ascus is a more highly developed and specialized modification of the sporangium of the Zygomycetes, it is plain that the very different methods of cleavage in the two cases are opposed to the assumption of any close relationship between them. In fact, it seems rather difficult to imagine any intermediate stages which could connect the process of cleavage by surface-furrows, as seen in the sporangium, with the free cell-formation of the ascus. * * *

"The total dissimilarity of the process of cleavage in the sporangia described and the ascus as I have shown it in the above account, makes it necessary to look for the ancestors of the Ascomycetes elsewhere than in the lower Fungi. Thaxter's studies of the Laboulbeniaceae have emphasized greatly the resemblance of that group to the Florideae and the hypothesis of the multiple origin of the Fungi from the Algae has gained correspondingly in strength. * * *

"We can say, however, as noted above, that the unlikeness in the method of spore-formation in the ascus and the sporangia which I have studied, makes it impossible to assume any very direct relationship between the Phycomycetes and Ascomycetes."

SHORT NOTES.

COULTER and Rose contribute an important paper to the Proceedings of the Washington Academy of Sciences, consisting of a synopsis of Mexican and Central America Umbelliferae, in which all the data with respect to the umbelliferous flora of the region under consideration are brought together. Thirty-nine genera and one hundred and eighty-two species are enumerated.

AN interesting paper by O. Borge of Stockholm, on the fresh-water algae of Franz-Josefs-Land (Süsswasseralgen von Franz-Josefs-Land, Köngl. Vetens. Akad. Förhandl, 1899) enumerates the plants collected by the Jackson-Harmsworth Expedition. No less than forty-three species, representing twenty-two genera, are enumerated. These genera range from *Oscillatoria*, *Nostoc*, etc., to *Cosmarium*, *Spirogyra*, *Vaucheria* and *Oedogonium*. One new species is described, namely, *Monostroma fisheri*, of which, oddly enough, a variety, also (var. *minor*) was found.

C. G. LLOYD continues his 'Mycological Notes' (No. 4, November, 1899) and takes up the genus *Psalliota*, describing six species and varieties, and enumerating eighteen or twenty

others which have been recorded as occurring in this country. Some of the latter are rare, some of doubtful occurrence, while others are based on erroneous determinations.

The report of the Botanist of the United States Department of Agriculture, recently issued, gives one some idea of the many kinds of work taken up by that division, including poisonous plants, seed testing, seed and plant introduction, economic plants of the tropics, etc.

Botanists may obtain a suggestion as to how to secure the publication of some of the matters they wish to distribute to the people, from a tiny pamphlet on the 'Stinking Smut of Wheat,' by Professor Bolley, of the North Dakota Agricultural College, which was 'published for the farmers of Minnesota and North Dakota' by one of the enterprising railway lines. It is popularly written, and at the same time is scientifically reliable.

Recent 'Contributions to the Flora of Queensland' by F. M. Bailey, Colonial Botanist, enumerate and describe many new plants, and call attention to certain plants 'reputed to be poisonous to stock.'

A recent report on the 'Timber Trees of the Herberton District of North Queensland,' by J. F. Bailey, assistant to the Colonial Botanist, is interesting to American botanists on account of the fact that but one of the genera enumerated (*Zanthoxylon*) is native to this country. One obtains little idea of the appearance of the Queensland forests from an examination of the descriptive list of one hundred and eleven names. What notion, for example, does one have of species of *Acronychia* and *Halfordia* (Rutaceae), or *Blepharocarya*, *Euroschinus* and *Pleiogynium* (Anacardiaceae), or *Aleurites*, *Baloghia* and *Mallotus* (Euphorbiaceae)?

The successive numbers of the *Forester*, 'a monthly magazine devoted to the care and use of forests and forest trees and to related subjects' contain so much that is botanical, and are so beautifully illustrated that we cannot do otherwise than commend it to botanists as a most helpful journal.

Charles E. Bessey.
The University of Nebraska.

SCIENTIFIC NOTES AND NEWS.

Sir Michael Foster has been returned to Parliament as representative of the University of London. The final vote was: Sir Michael Foster, 1271; Dr. Collins, 863; Dr. Busk, 586.

The Paris Academy of Sciences has elected as a corresponding member, Dr. H. G. Zeuthen, professor of mathematics at the University of Copenhagen.

Professor C. Barus, of Brown University, has been asked by the committee in charge to present a report on pyrometry at the International Congress of Physicists of the Paris Exposition.

Professor Ira Remsen, of Johns Hopkins University, will deliver the address at the dedication of the new chemistry building of the University of Kansas next fall.

The following named botanists and zoologists have recently joined the Washington Academy of Sciences as non-resident members: C. E. Bessey, University of Nebraska; John M. Coulter, University of Chicago; G. L. Goodale, Harvard University; C. S. Sargent, Arnold Arboretum; W. P. Wilson, Philadelphia Commercial Museums; W. B. Scott, Princeton University; Henry F. Osborn, Columbia University; David S. Jordan, Stanford University; William Brewster, Cambridge, Mass.; J. A. Allen, American Museum of Natural History; E. A. Andrews, Johns Hopkins University; H. C. Bumpus, Brown University; Carl H. Eigenmann, Indiana University; Walter Faxon, Harvard University; Chas. H. Fernald, Mass. Agricultural College, S. A. Forbes, University of Illinois; Simon H. Gage, Cornell University; Samuel Garman, Museum of Comparative Zoology, Cambridge; Alpheus Hyatt, Boston Society of Natural History; C. C. Nutting, State University of Iowa; Arnold E. Ortmann, Princeton University; W. E. Ritter, University of California; R. E. C. Stearns, Los Angeles, California; R. P. Whitfield, American Museum of Natural History; Edmund B. Wilson, Columbia University.

As we have already announced, Professor R. W. Wood, of the University of Wisconsin, is at present in England, having been invited by the Society of Arts to lecture on 'The Method of

Color Photography by Means of Diffraction Gratings,' which he has described in this JOURNAL. This lecture was announced for February 14th. Professor Wood was invited while in London to lecture before the Royal Society on February 15th, his subject being 'Photographs of Sound Waves and the Kinematographic Demonstration of the Evolution of Reflected Wave Fronts,' and before the Physical Society on February 23d, on these and several of his other recent discoveries in physics. He has also been invited to lecture before the Royal Photographic Society and the Camera Club.

WE learn from the *Botanical Gazette* that Dr. Douglass A. Campbell, professor of botany, in Leland Stanford University, has been spending some time in the University of Berlin and is at present in Egypt.

THE Prussian Ministry of State has expelled Dr. Arons, docent in physics at the University of Berlin. It will be remembered that charges were brought against Dr. Arons for advocating the doctrines of social democratic party and that the University Senate refused to discipline him.

WE regret to record the death of President James H. Smart of Purdue University, Lafayette, Ind.

THE death is announced of Professor Charles Piazzi Smyth, the astronomer. He was the son of Admiral William Henry Smyth, a well known hydrographer and astronomer, and was born at Naples in 1819. He began his astronomical work at the Cape of Good Hope in 1835 and was appointed Astronomer Royal of Scotland and Director of the University of Edinburgh in 1885. He is best known to the general public for his publications on the 'Great Pyramid.'

THE death is also announced of Mr. Leander J. McCormick who founded the observatory at the University of Virginia which bears his name.

THE Royal Institution, London, has received for the promotion of experimental research at low temperatures, £100 from Sir Andrew Noble. The Institution has also received £100 from Mr. Charles Hawksley, and £25 from Mr. Frank McClean.

EX-REPRESENTATIVE Isaac Stephenson of Marinette, Wis., has announced his intention to give to that city a public library building, to cost $50,000.

ON the evening of February 21st, the Trustees of the Corcoran Gallery of Art, at Washington, D. C., gave a reception to the Washington Academy of Sciences and their guests, the American Institute of Mining Engineers. The spacious halls of the gallery were thrown open and a considerable assemblage was present notwithstanding a very stormy evening.

THE following delegates representing scientific organizations, have been assigned from the District of Columbia to attend the Pure Food and Drug Congress: *District of Columbia Chemical Society:* Professor W. H. Seaman, W. H. Krug, Professor Charles L. Reese, W. E. Patrick, J. K. Haywood, A. L. Brown; *Department of Agriculture:* Secretary James Wilson, Dr. D. E. Salmon, Dr. H. W. Wiley, William Saunders, Mr. W. N. Irvin, J. H. Brigham, Dr. W. D. Bigelow; *Army Medical Department:* Lieut.-Col. Charles Smart, Dr. William M. Mew; *Navy Medical Department:* Medical Director, Charles H. White; *Health Department District of Columbia:* Dr. Wm. C. Woodward, Professor J. D. Hird, Mr. H. C. McLean, Dr. W. C. Fowler; *American Pomological Society:* Professor Wm. A. Taylor; *Commissioners of Pharmacy:* Dr. John T. Winter, Dr. W. P. Carr, G. G. C. Simms; *Pharmaceutical Association:* W. G. Duckett, H. A. Johnston, R. M. Harper; *College of Pharmacy:* W. S. Thompson, F. M. Criswell, S. T. Hilton.

THE preliminary announcement has been issued for an International Congress of General Botany to be held at Paris from the 1st to the 10th of October of the present year. The official language of the Congress will be French, but papers in other languages will be accepted if they are accompanied by a brief abstract in French. Abstracts must be received not later than September 16th. The president of Congress is M. Prillieux, and the secretary, M. Perrot, École Supérieure de Pharmacie, Paris.

AN International Congress of Navigation will be held at Paris from July 28th to August 3d. It will include in its scope not only navi-

gation of the sea, but also the navigation of rivers and canals.

THE House Committee of Mines and Mining has acted favorably on a bill creating a department of mines and mining, with a cabinet minister. The Geological Survey would be transferred to this department. There is also, as we have also reported, a bill before Congress establishing a department of Commerce and Manufactures, to which it is proposed to transfer the U. S. Geological Survey, as well as the U. S. Coast and Geodetic Survey, the Patent Office, the Commission of Fish and Fisheries, and the Bureau of Navigation. The Treasury Bureau of Statistics and the Bureau of Foreign Commerce of the State Department are to be consolidated into a single bureau of the department. The principal new offices created are the secretary and assistant secretary of commerce and industries, the secretary receiving a salary of $8000 and the assistant secretary $4000.

THE Ontario government has completed arrangements for the formation of a forest of almost 3000 square miles, embracing the district in which Lakes Temagami and Lady Evelyn are situated. The bulk of the reserve is virgin forest, with the finest white pine in Canada upon it.

THERE were 533 deaths from the plague in Bombay during the week ending February 16th. Up to February 17th there have been 42 cases of the plague and 32 deaths at Manila. The influenza is seriously epidemic throughout Europe and has been increasing during the past two weeks in New York and other cities.

FOR the accommodations of those who wish to view the eclipse of the sun, which takes place on May 28th, Messrs. Cook have arranged a conducted tour, leaving London, May 21st, visiting Paris, Bordeaux, Biarritz, Madrid and Talavera, where the total phase of the eclipse will be visible.

A TELEGRAM has been received at the Harvard College Observatory from Professor Kreutz, at Kiel Observatory, stating that "Comet *a* was observed by Javelle at Nice, Feb. 17.^{d}3148 Greenwich Mean Time, in R. A. $2^h\ 22^m\ 2^s.8$ and Dec. $-1°\ 19'\ 27''$." The check word shows that there is an error in this telegram, although it has been correctly repeated from Kiel. A cablegram, asking information, was sent to Professor Kreutz, but no reply has yet been received. If we assume an error of 10° in the addition, the message will check. The observation can not have been made on February 18th.

THE thirty-fifth volume of the *Zoological Record* has come to hand. Although chiefly relating to the year 1898, it includes the literature of the Coelenterata for 1897 and 1898. Copies may be obtained of the Secretary of the Zoological Society of London. Price, 30 shillings.

A NEW edition—the second—of 'Recent and Coming Eclipses' by Sir Norman Lockyer is now ready. It contains an account of the observations made at Viziadarog, in India, in 1898, and of the conditions of the eclipses visible in 1900, 1901 and 1905.

THE Duke of Devonshire and the President of the Board of Trade received, on February 5th, a deputation which presented a memorial asking for the continued maintenance of the Buckland Museum of Economic Fish Culture. The memorial stated, as we learn from the London *Times*, that the late Frank Buckland, who was appointed one of her Majesty's Inspectors of Fisheries in 1866, formed the museum at his own expense to aid the practical study of fish and fisheries and to teach people, through the eye, their practical value. He cast for it, mostly with his own hands, 400 specimens of fish, and collected a large number of objects illustrating fish and oyster cultivation and preservation and the modes of taking fish. This museum he bequeathed to the nation on trust to form part of the national collection at South Kensington Museum, and he also bequeathed £5,000, after his widow's death, to found a professorship of economic fish culture in connection with the museum. The gift and its conditions were formally accepted by the Department of Science and Art in 1881; but in 1898 the Select Committee appointed to inquire into and report upon the administration and cost of the museums of the Science and Art Department recommended that the Museum of Fish Culture should be abolished. The me-

morialists offer various reasons why this recommendation ought not to be sanctioned. Among other things they recall the fact that at the closing ceremony of the Fisheries Exhibition of 1883 the Prince of Wales said: "I think our duty towards the supporters of the exhibition will not be discharged until we have done something towards the promotion of that application of science to practice from which the fishing industry, like all other industries, can alone look for improvements." The Prince proposed the formation of a society having for its objects the collection of statistics and other information relative to fisheries, the diffusion among the fishing population of a knowledge of all improvements in the methods and appliances of their calling, the discussion of questions bearing upon fishing interests, and the elucidation of those problems of natural history which bear upon the subject. To extend the usefulness of the museum on these lines, and also on lines suggested by Professor Huxley, the coöperation of the Board of Trade appears to the memorialists to be essential. They suggest various directions in which such coöperation could be usefully afforded by inspectors of fisheries and others, and they submit that to disperse or neglect the museum would be a retrograde step unworthy of a great maritime country, a breach of an engagement of the Government, and an injustice to the memory of an able public servant. They ask that the museum shall be maintained and exhibited at South Kensington permanently and in a proper and efficient manner in accordance with the terms of the bequest accepted by the Department of Science and Art, and that such steps may be taken, in accordance with the suggestions of the Prince of Wales, as may be deemed expedient for securing its permanent usefulness in the interests of the river and sea fisheries of the United Kingdom. The memorial is signed by the Dukes of Richmond, Bedford, Northumberland, Sutherland, Westminster, and Abercorn, the Marquises of Tweeddale, Bute, Dufferin, Worcester, and Granby, the Earls of Home, Stamford, Sandwich, Jersey, Portsmouth, Radnor, Kimberley, and March, Lord George Hamilton, Viscount Powerscourt, Viscount Folkestone, Lords Massy, Chelmsford, Tweedmouth, and St. Levan, Lord Justice A. L. Smith, Sir William Harcourt, Sir Edward Birkbeck, together with representatives of the Fishmongers' Company, of various fishery boards and angling societies, inspectors of fisheries, and many others.

UNIVERSITY AND EDUCATIONAL NEWS.

INSTRUCTION IN ARCHÆOLOGY AND ETHNOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

DR. DANIEL G. BRINTON, for thirteen years Professor of American Archæology and Languages in the University of Pennsylvania, died July 30, 1899. His death was more than a great loss to the University—it was in a sense an irreparable loss. He had long been recognized as foremost among the students of the aboriginal languages of North America, and in that branch of research no one could be found to take his place. Dr. Brinton himself, however, shortly before his death, took steps towards ensuring in the University the permanence of the work to which he had devoted himself. He presented to the institution his library of works relating to the aboriginal languages of North America, comprising about 3000 volumes and embracing a large number of unpublished manuscripts as well as nearly all the printed material now extant. He had also recommended the appointment of his friend and co-worker, Mr. Stewart Culin, as Lecturer in Ethnology and American Archæology, and shortly after his death Mr. Culin was named for that position by the authorities of the Graduate School and was appointed by the Board of Trustees.

Mr. Culin has long been connected with the Museums of the University, and is now the curator of the Section of Asia, and General Ethnology. He is the author of between twenty and thirty published papers and monographs, and is best known by his work on Games. He was the first to show definitely that the games of all civilized races are descended from certain divinatory practices, many of which still exist among primitive peoples with their original significance unobscured.

During the year 1900–1901 Mr. Culin will offer courses upon the outlines of American

Archæology and upon Comparative Ethnology. In order to systematize still further the work offered in Archæology, Dr. Hillprecht, Professor of Semitic Philology and Archæology; Dr. Clay, Lecturer in Assyrian, Hebrew and Semitic Archæology, and Dr. Bates, Lecturer in Greek and Classical Archæology, have been associated with Mr. Culin in the administrative group entitled Archæology and Ethnology, and will offer courses next year in Babylonian and Early Hebrew and Phenecian Paleography. The Life and Customs of the Early Babylonians, Hebrew Archæology, Greek Epigraphy and Greek inscriptions.

It is the intention of the University to develop the work in Archæology and Ethnology in connection with the Free Museum of Science and Art. The collections now in the Museum offer students of Early Babylonian Archæology opportunities unrivalled in America, and in some respects unexcelled in the world. The material relating to the primitive culture of North America and of Borneo is also very rich, and that relating to Egyptian and Classical Archæology is sufficient to render substantial aid to instructors in those departments.

GENERAL.

President Gilman of Johns Hopkins University has made a plea before the finance committee of the Maryland Senate for a renewed State appropriation of $50,000 annually for two years. After enumerating the losses sustained by the university in the depreciation of Baltimore and Ohio Railroad stock values and the suspension of dividends, he said: The expense of maintaining the university is not far from $200,000 a year. The income from investments is $100,000. The income from tuition, $50,000. These are all round numbers, varying a little year by year. Unless the deficit of $50,000 can be made up, contraction must follow. Contraction will bring great discredit, for it will be known throughout the land. Students will drop out and a period of anxiety will follow. The university has no debts. Its capital invested in land, buildings, books and apparatus, is $1,000,000. It has excellent friends, wide reputation, and the hopeful prospects of large gifts. But it cannot anticipate the legacies which are known to be drawn in its favor. What is needed is a continuance of the aid which the last Legislature gave for two years more.

The condition of affairs at the University of Cincinnati is extremely unfortunate. The University occupies a somewhat peculiar position being a municipal institution with its Board of Directors appointed by the Superior Court of Cincinnati. It was founded by a citizen of the city with a considerable endowment and has received gifts from other citizens; but it has received its site and central building from the city and obtains three-tenths of a mill from the city tax list. It is regarded as the head of the public educational system of Cincinnati and the students are nearly all from the city. The experiment of a municipal university is certainly interesting and it is unfortunate that its future is at present endangered by political and personal factions. The condition of affairs has already been briefly reported in this Journal. Of the twelve members of the academic faculty, eight have been compelled to withdraw, no definite charges having been made. Several of them are men of science with established reputation. Of the four remaining professors one has resigned as a protest against the action of the Directors. He has published an open letter condemning in very outspoken language the action of the president. At a meeting of the Board of Directors on February 19th, a committee of citizens presented a protest, but the Board refused to give the Faculty a hearing.

Mr. James Russell Parsons, Jr., has been elected Secretary of the University of the State of New York.

Dr. Wilhelm Wien, professor of physics at Giessen, has been called to Würzburg as successor to Professor Röntgen.

Dr. Stanislaus Ciechanowski has been appointed assistant professor in the University of Crakow, and Professor v. Hertling, of Munich, has been called to the professorship of philosophy at Bonn, in the place of the late Dr. Neuhäuser.

Dr. E. Ashkinass has qualified as docent for physics in the University of Berlin, and Dr. U. Belu for physics and Dr. Reitter for chemistry in the University of Bonn.